PROJECTIONIST

INTERNATIONAL

JUNE 1951

VOLUME 26 • NUMBER 6

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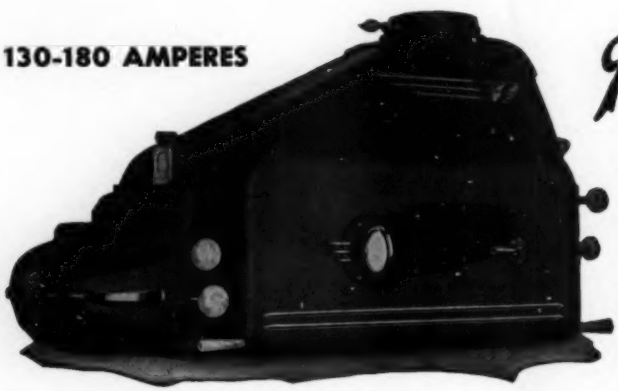

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With Which Is Combined PROJECTION ENGINEERING

HENRY B. SELLWOOD, *Editor*

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MONTHLY CHAT

MANY hundreds of words anent various aspects of theater television have appeared in this corner, with very few of them even faintly suggestive of enthusiasm as to the course being followed by the exhibition field in developing Tv into a potent box-office assist. Happenings of the past month, however, have clearly indicated that the film industry no longer intends to stand idly by and see its economic structure swept away by the onrush of Tv in the home field.

It remains to be seen whether exclusive programs offered via theater Tv will prove a strong enough magnet to make people bestir themselves and move out of their homes to the theater—the notion of free Tv programs has become firmly imbedded in the public mind.

But the existence of 100 definite orders for theater Tv units, with many more a likely possibility within the next few months, plus the vigorous action of an exhibitor group in pressing for exclusive program fare (mostly sports, it's true) augurs well for the future.

The recent Joe Louis-Lee Savold boxing match, by no means a first-class attraction, filled a 3346-seat Albany, N. Y., theater to overflowing, with standees six rows deep and other patrons sitting in the aisles. This, at a higher admission price and with a line of patrons several blocks long standing in the rain for several hours waiting to gain admittance. New York newspapermen assigned to cover the event expressed amazement at the showing and stated that sports promoters had the answer to their recent box-office woes.

Whatever develops on the theater Tv front, the organized crafts in the amusement field—from cameramen right down the line to the theater stage and projection room—should lose not a day in exploiting their present strategic position and moving in on Tv on all fronts. The first requisite, of course, is competency, and this may be accomplished only by prompt and sustained action by craft officials in providing their members with a means to learn every angle of the Tv set-up. This will take a tall lot of doing, but done it must be—and at once.

In those areas in which theater Tv units are already installed, as well as those spots to be ready soon, the organized craft should miss no opportunity to familiarize themselves with both equipment and technique. Following this, there should be intensive and extensive exchange of information between craft units.

Information relative to the fundamentals of the Tv art may be obtained in a variety of ways, including the printed page, but there is no substitute for actual experience in handling the equipment itself under actual showtime conditions. This much having been done, there will be no cause for recriminations and self-reproach no matter what develops in the theater Tv field.

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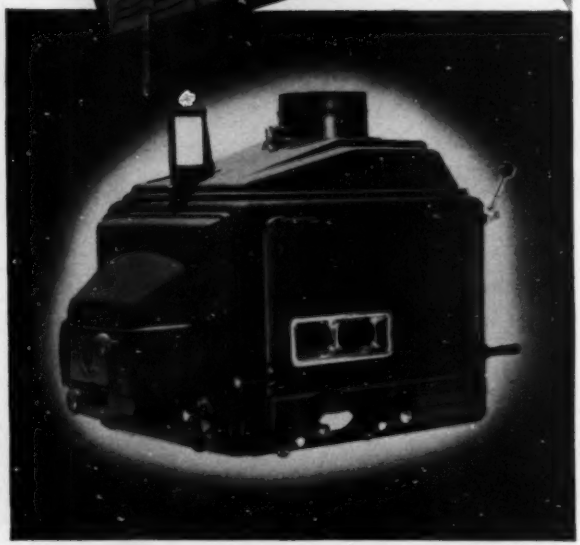

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"THERE'S A BRANCH NEAR YOU"

VOLUME XXVI JUNE 1951 NUMBER 6

Lens-Correction: What it Means

By ALLEN E. MURRAY
Scientific Bureau, Bausch & Lomb Optical Company

Despite IP's extensive coverage of projection optics, the color-correction of lenses still is not generally understood, a recent survey of reader-preference indicates. This topic has been covered previously in IP, but the imminent advent of theater Tv, with its more exacting color-correction requisites, lends timeliness to the accompanying summary of the latest data on this topic.

COLOR-CORRECTION in lenses is not a new wrinkle introduced as a consequence of the growing popularity of color film. Lens designers and opticians have been laboring over the color-corrections since the first lenses were assembled into optical systems. The term "color-corrected" is not so profound that, like "abracadabra" or "open sesame," it should become a conjurer's word to call up the perfect lens. "Color-corrected" to the optical designer and optician has a very definite meaning, much as it may have been corrupted to include application to almost any type of lens.

A color-corrected lens, in the language of the designer, is one satisfying two rather stringent specifications, and no lens failing to fulfill these two requirements can fairly be called "fully color-corrected."

Historically, unwanted color in images was recognized very early, and constituted one of the first challenges to the lens designer's skill. The researches aimed at discovering the whys and wherefores of this annoying color led to a better understanding of lenses in general, and to new glasses, and even today are not completed.

The state of the color-corrections in a lens system is fundamental in the performance of the system and constitutes one of the first considerations in design. The subject is rather complicated, as there are in reality two distinct color aberrations the designer must eliminate before he is entitled to say that his system is color-corrected.

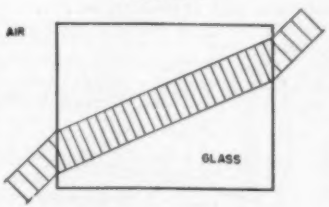
The Behavior of Light

But before we undertake to amplify this statement, we must refresh our memories with a few facts of how light behaves.

Light travels in vacuum at the astounding rate of 186,000 miles per second: that is, *all* light is conjectured to do so —blue, yellow, red, infra-red, *etc.*—it all skips merrily along at this dizzy rate in empty space.

But something happens to this light when it reaches a region filled with a more tangible substance. What happens is exactly the same thing that occurs when a train hits a snow bank, or a football player enters a broken field—a reduction of speed. At the boundary of the optically denser medium, the light beam is bent, or refracted, if the angle at which the beam hits the denser medium is other than 90°.

FIGURE 1



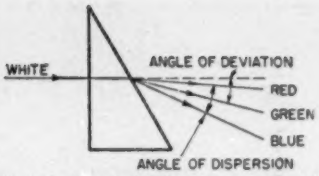
Specifically, as Fig. 1 shows, on entering a medium in which the speed is less the beam of light is bent toward the normal, an imaginary line perpendicular to the surface. The reverse is true on leaving.

The crux of the color effects is that in spite of the fact that all colors are transmitted through empty space with the same velocity, they insist upon being treated differently when traveling through ponderable matter. In glass, for instance, red light will travel about 3,000 miles per second *faster* than blue light. This speed differential has as its consequence the greater bending of blue light over red light, causing the dispersion shown in Fig. 2.

Achromatic Lens Combinations

In the design and manufacture of photographic objectives, several different types of glass are used whose basic action is illustrated in Fig. 2. One type is of low index of refraction, *i.e.*, it retards light little in passage. This glass, in general, will retard the blue only slightly more than the red.

At the other extreme are the glasses of high index, in which the velocity of light is lower, and this in turn means a greater angle of deviation whereby the blue is affected much more than the red,



Showing action of white light entering material of low refractive index.

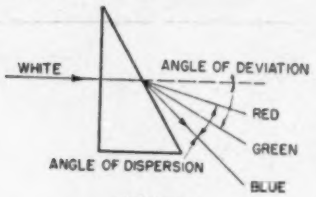


FIGURE 2

White light entering material of high refractive index, at the same angle as above.

so that the angular dispersion is greater.

Sir Isaac Newton, who founded much of optics as we now know it, from his extensive experience with the glass prisms of his day, concluded, erroneously, that dispersion is always proportional to the deviation and that, as a consequence, achromatic combinations are impossible. Sir Isaac committed one of his rare mistakes in concluding that achromats are impossible and that the reflecting telescope is the best answer to the color problem.

Not long after Newton's death, the first achromats were made in England by combining a positive crown and negative flint lens to produce the basic type of achromatic doublet.

We have seen in Fig. 2 that a ray of light, upon passage through a prism, is bent, or deviated, in the direction of the base. This is essentially the fundamental reason for the action of lenses of all kinds. The curved surfaces act like an assembly of an infinite number of small prisms, deviating each ray striking the surfaces sufficiently to bring it to a reunion, real or virtual, with the other rays forming the image.

A positive lens will *converge* parallel rays to a real focus; while a negative lens will *diverge* parallel rays, making them act as if they came from a point, the virtual focus.

From what was said previously concerning dispersion, it is apparent that *any simple lens cannot have one definite, fixed focal point for all light.* Since the light-bending power, or refractivity, of glass is greater for blue than for the red, the blue light will focus at a point nearer the lens than the red. This situation is illustrated in Fig. 3. This is the simplest and most readily grasped type of chromatic aberration, and usually the first corrected.

In practice, this longitudinal chromatic aberration will mean that there is no one focal point on the axis but several, depending on the color of the light used. A photograph made with a simple positive lens would show a large shift from visual focus to photographic, even with panchromatic negative material. The "chemical focus" of the old-time photographers was of this nature.

Axial Chromatism Correction

A perfect lens cannot be made, and even in the best lenses there remains a very small residual of this aberration, so that when a color-blind emulsion responding only to the blue is used, a shift towards the lens is usually necessary—the so-called "chemical focus." This effect is familiar also to those who have used infra-red sensitive emulsions in their cameras: for best results, it is usually necessary to rack the lens *out* a trifle.

A further result of this irresolution of focal points is the situation shown in Fig. 3, where at the blue focus the red rays create a red disc, and at the red focus the blue rays create a blue halo. A point object could hardly be photographed as a point under these conditions.

This axial chromatism is not difficult to correct and, as noted before, is given high priority. The secret lies in the relation of dispersion to deviation. Consider for a moment a simple positive lens as shown in Fig. 3. The marginal rays have been deviated toward a focus, and at the same time because of the dispersion of the glass, the red and blue rays are aimed at different points on the axis.

Now, everything would be perfect if there existed an optical material with a given amount of dispersion and no refractive power, for then correction could be effected with a plane parallel sheet of this wonderful material. Actually, the only practical material for this task is a glass which has a fortuitous relationship of refractivity to dispersion such that the dispersion will effectively cancel that of the positive lens, while the refractivity is insufficient to cancel completely the convergence of the positive lens.

The lens component effecting this achromatism is negative, as shown in Fig. 4, and must have higher refractivity and dispersion than its positive mate.

This combination, then, will bring light of any two colors to a common focus on the axis. The other colors will focus at points practically identical with the chosen colors. Thus this lens would give a color-free star image on the axis.

Other Chromatic Aberration

The other type of chromatic aberration is a bit more difficult to understand. It is somewhat more complicated both to explain and to show in a drawing. Some of us may recall mention in our reading concerning optics of certain things called "cardinal points," "ideal planes," *etc.* These points and planes are convenient ways of describing the properties of lens systems and are indispensable to the lens designer.

Briefly, these cardinal points can be looked on as points on the lens axis at which the refractive powers of the lenses or lens system are concentrated. The cardinal points and planes are exceedingly useful because they simplify computations by replacing a complex, almost

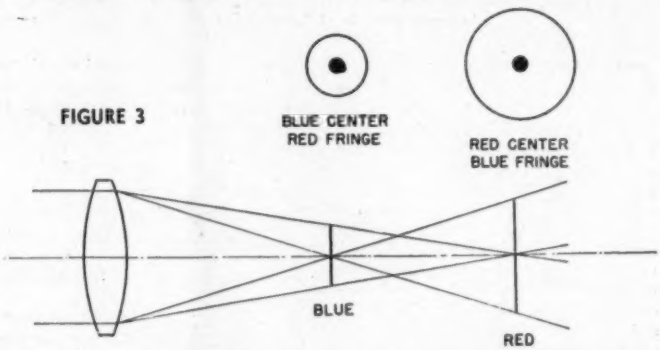


FIGURE 3

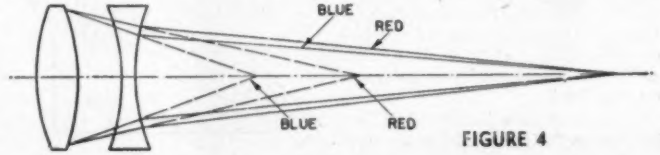


FIGURE 4

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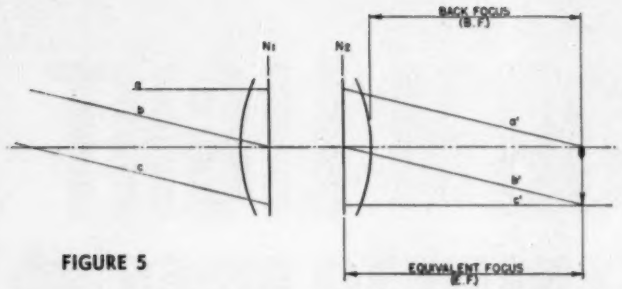


FIGURE 5

unmanageable system by points at which all the refraction can be considered to occur, or more graphically, by thin lenses whose laws are simple and easy to handle.

Irrespective of the distance from the rear surface of the lens to the focal point in parallel light (B.F.) the equivalent focal length (E.F.) of a lens is defined as the distance from the second nodal point (cardinal point) to the second principal focal point (Fig. 5).

We are all familiar with the fact that even with infinitely distant objects the image size is proportional to the focal length of the lens used. The 50-mm lens on miniature cameras will yield an image one-third the size of that formed by a 6-inch lens.

Now, it is a most unfortunate fact that the cardinal points have positions dependent on the refractive index of the glass comprising the lens. Expressed in other words, each color has its own cardinal points which can be distinct from those of any other color. Now, if the lens is color-corrected axially, i.e., if the red and blue colors unite in one focal point on the axis, and if the nodal points in the two colors are different, automatically the lens must have different focal lengths in the two colors. This is shown in Fig. 6.

However, these different focal lengths, as we saw previously, mean differently sized images: that is to say, the magnification will be different, depending on the color (Fig. 7). It is for this reason that this second type of chromatism is spoken of as chromatic difference of magnification, or lateral color.

Lateral Color Aberration

In a lens afflicted with this aberration the points in the margin of field are drawn into spectra, or rainbows. This particular aberration is most annoying even with black-and-white film, for it quickly sets the limit of usable field by producing a graded soft focus near the margins.

In the correction of this aberration, advantage is taken of the fact that some lens system will give a spectrum with the red end closer to the axis; while others will give a rainbow oriented the other way around. In the correction of lateral color, then, systems of these apposing characteristics are balanced against each other until a satisfactory compromise is found.

We have now seen the two types of pure chromatic aberration—longitudinal chromatic aberration, and chromatic difference of magnification. The former, the simpler type, is manifested by the absence of one single focal point for all colors, with the existence of a distant point for each separate color. This is a very troublesome aberration and is corrected in all but the most inexpensive lenses. These lenses can be spoken of as being "color-corrected" only to the extent that there is little or no shift of focal point with color.

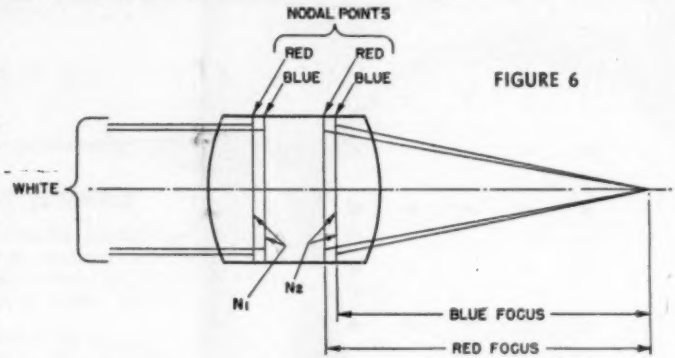


FIGURE 6

This aberration is in theory independent of the aperture of the lens, though in practice its effects will be mitigated by stopping-down, for then the effective depth of focus is increased and the image is less sensitive to improper focus. Longitudinal chromatic aberration is corrected by combining a positive lens with a negative lens of higher refractive index and dispersion and of such power that the dispersion of the positive lens is annulled, but its convergence not canceled, so that a union of the red and blue colors occurs on the axis.

'Full Color-Corrected'

The second chromatic aberration is more complex and manifests itself in differently sized images in different colors. This chromatic difference of magnification is troublesome even in black-and-white photography, and the best lenses are corrected for this aberration.

Only the photographic objectives designed with this aberration pared to tolerable limits can be spoken of as "full color-corrected." This aberration is proportional to the image height, thus becoming worse toward the corners of the picture. Stopping down the lens is without effect on this aberration. It can be corrected by employing combinations of elements of opposing tendencies, so that one set cancels the effects of the preceding.

The corrected lenses of the reputable

(*Continued ft. of Col.* 1, *page* 10)

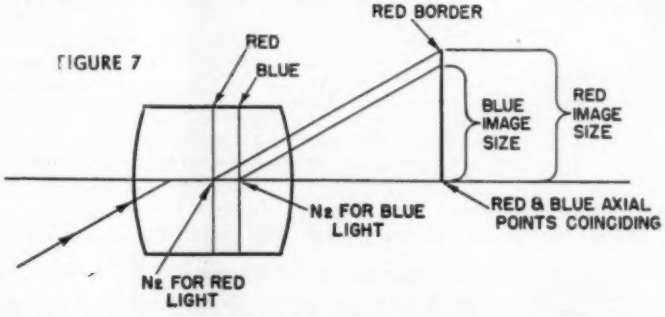
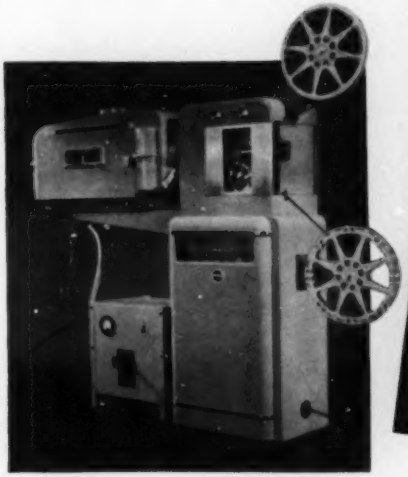
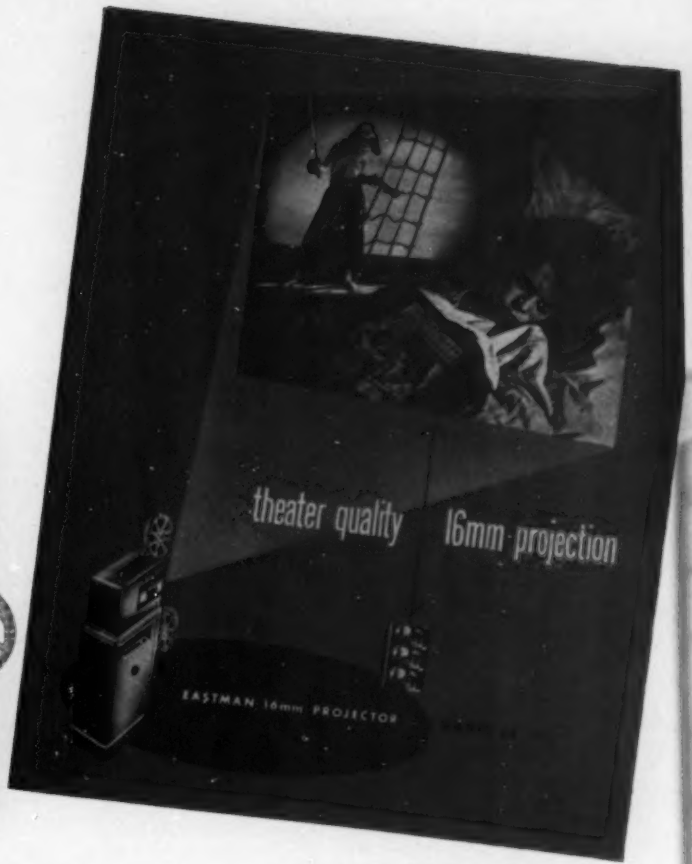


FIGURE 7

The Eastman 16mm. Projector,

MODEL 25





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Maskless Screen Steadily Gains Favor

Renewed interest in the maskless screen, and its concomitant of surrounding illumination, was very definitely in evidence at the recent SMPTE Convntion in New York. Supplementing the various articles on this topic which have appeared in IP over the past several years is the appended commentary by a prominent lighting engineer.

WITH the trend toward higher levels of schoolroom and industrial lighting, there is also a trend toward higher levels of illumination in theater auditoriums while the picture is on the screen. In addition to the obvious advantages from a public safety standpoint, another result is reduction of eyestrain resulting from reduced contrast between the screen and the area surrounding it.

Evidence from another quarter supporting the argument for lower contrast between visual task areas and their surround was available in abundance at the office equipment exhibits of the National Office Managers Assoc. Convention in New York recently. All desk manufacturers are offering tops more nearly the color of the paper you are looking at rather than the print you are reading. Even televiewing authorities tell Butch to have lights on in the room during the Hopalong Cassidy show.

Film Theaters Lagging Behind?

Why don't more theaters follow the swing? Now that large aperture lenses and methods of cooling the projector gate, the film and the carbon clamps are available, the majority of theaters are physically able to use larger screens and higher levels of screen brightness which permit a substantial increase of auditorium light. Add also an illuminated screen surround and the patrons will receive something new in the way of motion pictures.

Light borders are replacing dark in two ways:

1. The screen end of the auditorium is shaped like the inside of an egg shell (the big end) with the side walls and ceiling sweeping in at an increasing rate to meet the edges of the screen. Wall and ceiling are finished a very light color, almost white, and receive a great deal of diffuse reflected light from the screen.

Brightness Ratio Very Important

The ratio of apparent screen brightness to apparent surround brightness is set by the shape, texture and color of the walls and ceiling.

Once a desirable ratio is established it stays that way, because a high-key scene automatically has a fairly bright surround, and a low-key scene, such as the first reel of "Great Expectations," will reflect practically no light to the surrounding walls. It seems mighty important to select the brightness ratio that gives minimum fatigue, and this calls for clever architectural design.

A Typical Installation

The Crown Theater in New Haven, Conn., is an early practical example. There is no proscenium and there are no curtains. It is a small motion picture theater that does not feel the urge to hide its screen behind heavy drapes. During intermission the white screen is occupied with a slide projected from the projection room. The result is quite a pleasant one.

Britain's Telekinema System

2. Another and more complex system is being used in Telekinema, the motion picture exhibit featured at the Festival of Britain. The surround is projected along with the picture and uses light reflected from the rear of the projector shutter, which is silvered, and a special projection optical system that "works" only during the pull-down half of the projection cycle.

The result is an illuminated border synchronous with the picture, which requires no special attention on the part of the projectionist.

LENS CORRECTION

(Continued from page 8)

makers have all been designed with this aberration in mind and can justly be spoken of as being fully color-corrected. However, it is well to remember that nothing perfect is manufactured, and that with the most refined tests it might be possible to demonstrate some lateral color with the most nearly perfect lens made. This would be without significance, however, since the test necessarily would be artificial and would not correspond to the conditions of use of the lens. If the longitudinal chromatic aberration has been corrected, and if the lateral aberration cannot be detected on the film, for all practical purposes the lens is "fully corrected."

Full color-correction is as essential in the best photography and projection with black-and-white emulsions as it is with color film. The effect of lateral color in the case of the former is to create a soft focus effect toward the margins, while with color film registration difficulties are the consequence of this aberration.

Color photography and projection has introduced no new element into the design of good objectives. With color film the color aberrations, particularly lateral color, becomes visible as color defects. The best lenses have always been fully color-corrected.

Movies Two Miles Under Water

MOTION PICTURES of the expansion and contraction of explosion bubbles, taken at a depth as great as two miles under the surface of the ocean at a rate of 20,000 frames per second, are helping U. S. Navy scientists to gain new knowledge of the behavior, effectiveness and design requirements of underwater explosive weapons.

The explosion bubble is a gas globe formed by the hot, expanded gaseous products of detonation. The cameras used in a recent Navy project were an Eastman Hi-Speed, a 35-mm Fastax, and a rotating mirror frame camera best described as a modified Bowen. Each was shock-mounted in a heavy, watertight case.

Intricate Optical System Used

The latter camera, used for making studies at greater depths, was enclosed in a spherical case with an inside diameter of 22 inches and walls 1¼-inch thick. In this camera, the image is formed on a spinning mirror which has the focal axis of the taking lens system for its axis of rotation.

The plane of reflection of the mirror is 45 degrees to this axis. The image is thus reflected through the framing lens to the stationary film. With the mirror revolving at the rate of 18,000 r.p.m., 100 pictures can be taken at the rate of 30,000 frames per second. The light source most commonly used consisted of a number of focal plane flashbulbs having a flash duration of about 75 milli-seconds.

American equipment is featured around the world, as attested by this display of Simplex visual and sound projection equipment by Evergreen Pictures in the Taj Mahal Hotel, Bombay, India.

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The Strong Trouperette Incandescent Spotlight is especially popular with small theatres, schools, night clubs and industrial shows, where physical dimensions and price are factors and where the tremendous light volume of an arc lamp is not necessary. It can be plugged into any 110-volt convenience outlet.

It projects far more light than any conventional, incandescent spotlight. This increased brilliancy is made possible by a variable focal length objective lens system, a 5¼-inch silvered glass reflector and Fresnel lens used with a standard 115-volt, 1000-watt prefocused projection type bulb. As contrasted to the conventional incandescent spotlight, with which the spot size is varied solely by irising, to result in substantial light loss, the Trouperette utilizes all the light through most of the spot sizes. The Trouperette delivers 6½ times brighter head spots with sharp edges from head spot to flood. A horizontal masking control can be angled at 45 degrees in each direction. The fast operating color boomerang accommodates six slides. The mounting stand is adjustable for height.

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Tv Pot Boils Over; Movies Fight Back

THE Tv pot boiled over during the past month, with most of the heat being generated by the long-quiescent motion picture industry. While much too early to evaluate the end results of the frantic pushing and hauling that ensued in the entertainment arena during this period, it's a cinch that the coming year will be productive of events that will set the pattern for years to come. The developments were:

1. United Paramount Theaters merged with American Broadcasting Co. (subject to FCC and stockholder approval), and thus added five wholly-owned AM-FM-TV stations and 289 affiliated stations to the 650 theaters which it already controls. At least 22 of these theaters will be equipped with large-screen Tv equipment by early Fall.

2. A group of motion picture theaters obtained the exclusive rights, although on a restricted coverage basis, to the Joe Louis-Lee Savold heavyweight fight held at the Polo Grounds on June 13. No theaters in the New York and adjacent areas were included in the deal.

100 Theater Tv Sets in Work

3. It was learned definitely that more than 100 theater Tv equipments are now being manufactured by RCA — which means definite orders therefor.

4. Almost a certainty is that the exclusive rights to major college football games next Fall will be granted to Tv-equipped motion picture theaters.

5. Paramount Pictures Corp. (not to be confused with U-P Theaters), which already owns a substantial interest in the DuMont Tv-network and manufacturing facilities, purchased an interest in Telemeter, a coin-operated device attachable to home receivers thus presaging a possible Tv subscription service.

Paramount also revealed its 50% ownership of Chromatic Tv Labs, which makes a Tv receiver which will automatically tune to either black-and-white or color transmission, using a 16 or 21-inch direct view tube. This tube would eliminate the need for the rotating disk now used on CBS color transmissions.

RCA's Pay-as-You-See-System

6. RCA, parent company of the NBC radio and Tv network, formally confirmed for the first time that it has been working on a system of home pay-as-you-see Tv. "There are many ways of doing subscription television," said an RCA spokesman, "Anything that can be done over a wire can be done through the air."

7. The U. S. Supreme Court sustained the legal right of the FCC to approve the CBS system of rotating-disk color Tv as opposed to the RCA all-electronic color tube. Nothing daunted, RCA announced that it did not regard the controversy as ended, and moved promptly to begin experimental color transmissions and to make available to all tube and set manufacturers full details of its trichromatic color tube.

CBS howled that by this move RCA was again attempting to "delay color by making promises for the future." RCA replied that it was "goodbye to the disk —it's obsolete." Competent observers estimate that home receiving sets will not be affected by the court's decision for several years to come.

All these events are of too recent vintage and, probably, are so interdependent one upon another as to defy analysis, much less a forecast of their impact upon the future, even by those who are intimately associated with them. Time alone will design the pattern.

However, three facts of great significance to motion picture people emerge from the welter of events. These are:

1. The theater field has finally snapped out of a coma and come to the realization that it is do or don't, now or never. Witness: the definite orders for theater Tv equipments, and the evidence that it will make a strong bid for exclusive program material in the form of major events, sports or otherwise. Whether this move is too late, for better or worse, is unpredictable—but the will to fight back is at last evident in the tangible form of making an effort and spending money.

2. Inescapable is the fact that everybody concerned — promoters of major events, Tv networks, talent, manufacturers, movie theaters, and all the working crafts — has jumped on the bandwagon which is headed in the direction of some form of pay-as-you-see, whether in the home or in the theater, as a source of badly needed revenue.

3. The active participation of the large movie producers in the acquisition of Tv properties and their avid continuing scouting of future possibilities makes it inevitable that it won't be too long before they announce flatly their intent to make films for Tv.

In fact, several such units, even though in skeleton form, are right now active in the major Hollywood studios — *for a fact.*

UP-ABC Deal No Help

As for the purchase of ABC by UP, the mealy-mouthed joint announcement of the deal makes it obvious that the combine will do precious little good for if not actual harm to, the motion picture theatre. How about those 289 network affiliates?

As for the theater group gaining the exclusive on the Louis-Savold fight, this ice-breaker is significant only because of the statement by the boxing monopoly that this is but the "first of a series of such events that will go exclusively to the theater field."

And there are other angles to this deal. Admittedly, Louis and Savold was not a championship fight, and, in fact, was really not a first-class attraction. Then there is the circumstance of the promoters being turned down on their request for $100,000 from a Tv sponsor for the event, the highest bid being $60,000. It is doubtful that this outdoor attraction grossed even the latter figure at the gate.

Rather a mangy-looking first exclusive, but still a hopeful portent for the future.

The definite orders for theater Tv equipment and the exclusive on the major college football games brighten up the over-all picture—but positively.

Pay-as-You-See Movie Poison

This mad rush toward the pay-as-you-see goal could be poison for the motion picture theater. It indicates that home Tv as now set up is faltering and will ultimately be relegated to a plodding medium that can offer nothing but 15- and 30-minute segments plus a flock of wornout entertainers and, of vital importance, a dose of the most nauseating verbal garbage in the form of commercials that is ever foisted on the public.

Home Tv, however, would figure to dent the movie theater box-office by about 20%; but a practicable means for establishing a nation-wide pay-as-you-see home Tv service would zoom this figure to 50 or 60%—and goodbye movie theater. A thought: presently there are no channels available for such a service even if the FCC should grant approval.

Over-all, it appears that if the movie theaters can get through this summer in fairly good shape and keep pitching in the matter of acquiring more and more large-screen theater Tv sets and in snaring exclusive program fare, it might yet find itself in a spot where it would wind up with a respectable slice of the entertainment dollar.

Tv 15,000 Times Brighter!

In the past, projection Tv has failed to win public acceptance using projection tubes only 50 times as bright as direct-view tubes. "It now seems entirely feasible to build a receiver tube 6 inches long and less than an inch in diameter, which will have a screen brightness 15,000 times that of today's direct-view tube," declares Philo T. Farnsworth. "With such a tube we shall be able to use a built-in screen in the receiver or to adjust the set so that an image may be projected in 3 x 4-foot size on a separate screen or wall."

The Magic of Color

By ROBERT A. MITCHELL

Second in a series of articles on the "what", "why" and "how" of color.

TABLE A gives the intensity of vermilion, emeraude, and indigo lights required to produce the 48 hues (Fig. 3 is reproduced from the first installment for reader convenience). Zero means "completely off," while 100 signifies "full intensity." When all three lights are shining at full intensity (100, 100, 100), white light is obtained.

The hues are numbered in Table A in such a way that complementaries have the same number. If you add the light intensities for any two complementaries, you will find the sum to be 100, 100, 100.

The column headed *luminosity* indicates the relative visual brightness of the hues when moderately strong illumination is employed. Note that indigo is the least luminous, and yellow the most luminous, of the hues. Note also the slight irregularities in the way the luminosities vary. The relative luminosity indices of any two hues complementary to one another add up to 10 in all cases.

Table B gives the *percentage* of each primary in the 48 hues. The numbers in the column headed *multiplier* are worth special attention. They are significant in three ways.

First, by multiplying the percentages of components of each hue by the indicated multiplier, the values given in Table A are obtained.

Most 'Dazzling' to Eye

Second, the hues having the highest multipliers are the most "dazzling" to the eye (cyan, magenta, and yellow). All hues having the same multipliers are equally "dazzling," or colorful.

Third, the multipliers offer an astonishing empirical explanation of the hues commonly accepted as fundamental colors—true red, orange, etc. With the exception of yellow, the "true" hues have multipliers very close in value to 1:29 and 1.63. Here is how the correct positions of these hues are determined in the color scale:

Begin with *yellow*, which attracts attention because it is the most luminous hue. Proceeding down the list from yellow (and continuing down from the top of the list when the bottom has been reached), we find the *second* hue having the *same* multiplier, whether 1.29 or 1.63. This will be a "true" hue.

Xanth, we notice, is 1.6 (closest to 1.63), limonelle is 1.3 (closest to 1.29, *and green is 1.25* (closest to 1.29). This determines true green.

Continuing, we encounter aquamarine 1.625 *and blue 1.667*. This determines true blue.

Continuing, we encounter ultramarine 1.333 *and purple 1.3*. This determines true purple.

Continuing, we encounter mauvure 1.6 *and red 1.625*. This determines true red.

Continuing, we encounter scarlet 1.25 *and orange 1.333*. This determines true

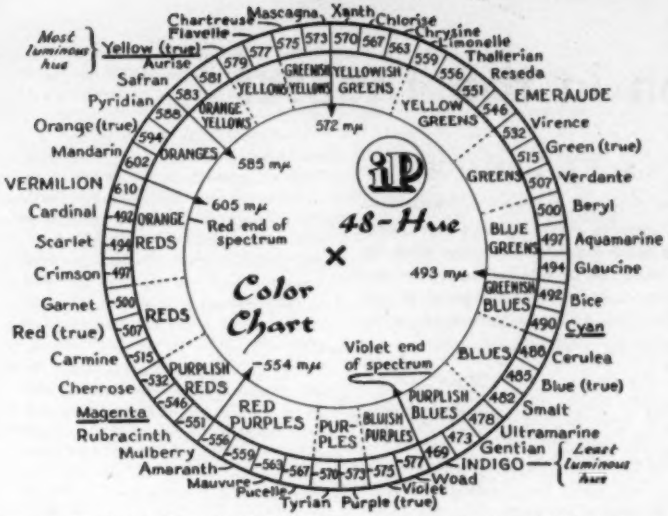
TABLE A. PRODUCTION OF COLORED LIGHTS BY MIXING PRIMARY HUES

	PRIMARY COMPONENTS Relative Light Intensities			
Hue	Vermilion	Emeraude	Indigo	Luminosity
1. Xanth	60	100	0	7.000
2. Chlorise	50	100	0	6.500
3. Chrysine	40	100	0	6.000
4. Limonelle	30	100	0	5.500
5. Thallerian	20	100	0	5.000
6. Reseda	10	100	0	4.500
7. EMERAUDE	0	100	0	4.000
8. Virenee	0	100	12.5	4.125
9. Green (true)	0	100	25	4.250
10. Verdante	0	100	37.5	4.375
11. Beryl	0	100	50	4.500
12. Aquamarine	0	100	62.5	4.625
13. Glaucine	0	100	75	4.750
14. Bice	0	100	87.5	4.875
15. CYAN	0	100	100	5.000
16. Cerulea	0	83.3	100	4.333
17. Blue (true)	0	66.7	100	3.667
18. Smalt	0	50	100	3.000
19. Ultramarine	0	33.3	100	2.333
20. Gentian	0	16.7	100	1.667
21. INDIGO	0	0	100	1.000
22. Woad	10	0	100	1.500
23. Violet	20	0	100	2.000
24. Purple (true)	30	0	100	2.500
1. Tyrian	40	0	100	3.000
2. Fucelle	50	0	100	3.500
3. Mauvure	60	0	100	4.000
4. Amaranth	70	0	100	4.500
5. Mulberry	80	0	100	5.000
6. Rubreoisith	90	0	100	5.500
7. MAGENTA	100	0	100	6.000
8. Cherrose	100	0	87.5	5.875
9. Carmine	100	0	75	5.750
10. Red (true)	100	0	62.5	5.625
11. Garnet	100	0	50	5.500
12. Crimson	100	0	37.5	5.375
13. Scarlet	100	0	25	5.250
14. Cardinal	100	0	12.5	5.125
15. VERMILION	100	0	0	5.000
16. Mandarin	100	16.7	0	5.667
17. Orange (true)	100	33.3	0	6.333
18. Pyridian	100	50	0	7.000
19. Safran	100	66.7	0	7.667
20. Aurise	100	83.3	0	8.333
21. YELLOW (true)	100	100	0	9.000
22. Flavelle	90	100	0	8.500
23. Chartreuse	80	100	0	8.000
24. Maseagne	70	100	0	7.500

TABLE B. PERCENTAGE COMPOSITION OF COLORED LIGHTS

	PR MARY COMPONENTS Proportions in Per Cent			
Hue	·ilion	Emeraude	Indigo	Multiplier
1. Xanth	37.50	62.50	0	1.6
2. Chlorise	33.33	66.67	0	1.5
3. Chrysine	28.57	71.43	0	1.4
4. Limonelle	23.08	76.92	0	1.3
5. Thallerian	16.67	83.33	0	1.2
6. Reseda	9.09	90.91	0	1.1
7. EMERAUDE	0	100.00	0	1
8. Virenee	0	88.89	11.11	1.125
9. Green (true)	0	80.00	20.00	1.25
10. Verdante	0	72.73	27.27	1.375
11. Beryl	0	66.67	33.33	1.5
12. Aquamarine	0	61.54	38.46	1.625
13. Glaucine	0	57.14	42.86	1.75
14. Bice	0	53.33	46.67	1.875
15. CYAN	0	50.00	50.00	2
16. Cerulea	0	45.45	54.55	1.833
17. Blue (true)	0	40.01	59.99	1.667
18. Smalt	0	33.33	66.67	1.5
19. Ultramarine	0	24.98	75.02	1.333
20. Gentian	0	14.31	85.69	1.167
21. INDIGO	0	0	100.00	1
22. Woad	9.09	0	90.91	1.1
23. Violet	16.67	0	83.33	1.2
24. Purple (true)	23.08	0	76.92	1.3
1. Tyrian	28.57	0	71.43	1.4
2. Fucelle	33.33	0	66.67	1.5
3. Mauvure	37.50	0	62.50	1.6
4. Amaranth	41.18	0	58.82	1.7
5. Mulberry	44.44	0	55.56	1.8
6. Rubreoisith	47.37	0	52.63	1.9
7. MAGENTA	50.00	0	50.00	2
8. Cherrose	53.33	0	46.67	1.875
9. Carmine	57.14	0	42.86	1.75
10. Red (true)	61.54	0	38.46	1.625
11. Garnet	66.67	0	33.33	1.5
12. Crimson	72.73	0	27.27	1.375
13. Scarlet	80.00	0	20.00	1.25
14. Cardinal	88.89	0	11.11	1.125
15. VERMILION	100.00	0	0	1
16. Mandarin	85.69	14.31	0	1.167
17. Orange (true)	75.02	24.98	0	1.333
18. Pyridian	66.67	33.33	0	1.5
19. Safran	59.99	40.01	0	1.667
20. Aurise	54.55	45.45	0	1.833
21. YELLOW (true)	50.00	50.00	0	2
22. Flavelle	47.37	52.63	0	1.9
23. Chartreuse	44.44	55.56	0	1.8
24. Maseagne	41.18	58.82	0	1.7

FIGURE 3



orange. Continuing down the list brings us back to yellow.

Color Filters or Mixed Paints

Table C is useful when we wish to reproduce hues by means of superposed color filters or by mixing paints—a much easier method but less accurate than mixing colored lights.

The values for superposed filters speak for themselves. When the deepest (most saturated) yellow, magenta, and cyan filters are laid on top of each other (100, 100, 100), no light can pass, and the result will be black. Note that the values for any two complementaries add up to black. Equal but lower values for the three filters (as 20, 20, 20) will produce neutral grays.

The percentage values for paints require a word of caution.The Y, M, and C pigments must be adjusted in strength beforehand (by diluting the one or two paints which may be too highly concentrated) so that *equal proportions* of the three will give a neutral dark gray.

The percentage values in Table C are very different, and vary in a different way, from those in Table B. There is no simple mathematical interrelation between these percentages and the density-proportions used in filter superposition. The matter is further complicated by the fact that the grays produced by mixing two complementary colored paints (with but three exceptions) do not contain equal amounts of yellow, magenta, and cyan.

Compound Colors Additively

This extraordinary state of affairs is due to the fact that the Y, M, and C pigments in the paints consist of small opaque, not transparent, particles, thus forming compound colors additively rather than subtractively. The color-mixing is subtractive *in method*, to be sure; but the color *formation* is actually largely additive.

Nor is the mixing of opaque Y, M, and C pigments the simple, easy-to-understand additive color-formation previously discussed—the mixing of vermilion, emeraude, and indigo lights only two at a time. When two secondary pigments are mixed, three primary components are involved. The resultant color balance is shifted in remarkable, sometimes unpredictable ways.

When a few drops of thick magenta paint and a like amount of thick yellow paint are placed side by side and stirred together with a toothpick to make vermilion, fugitive streaks of green suddenly appear and disappear during the mixing! The green streaks are unmistakable, even though faint.

All these very confusing complications need not concern us. It is enough to bear in mind that yellow, magenta, and cyan paints, and all other types of pigments which are viewed by reflected, rather than by transmitted, light cannot possibly make black when mixed together in equivalent proportions. The result is neutral gray, not black.

Those who wish to experiment with

(*Continued on page* 30)

TABLE C. SUBTRACTIVE FORMATION OF COLORS

PRIMARY COMPLEMENTARY COMPONENTS

	SUPERPOSED FILTERS Filter Color Density			OPAQUE PIGMENT MIXTURES Proportions in Per Cent		
Hue	Yellow	Magenta	Cyan	Yellow	Magenta	Cyan
1. Xanth	100	0	40	86%	0%	14%
2. Chlorise	100	0	50	80	0	20
3. Chrysine	100	0	60	74	0	26
4. Limonelle	100	0	70	68	0	32
5. Thallerian	100	0	80	62	0	38
6. Reseda	100	0	90	56	0	44
7. EMERAUDE	100	0	100	50	0	50
8. Virence	87.5	0	100	42	0	58
9. Green	75	0	100	35	0	65
10. Verdante	62.5	0	100	28	0	72
11. Beryl	50	0	100	21	0	79
12. Aquamarine	37.5	0	100	14	0	86
13. Glaucine	25	0	100	7	0	93
14. Bice	12.5	0	100	2	0	98
15. CYAN	0	0	100	0	0	100
16. Cerulea	0	16.7	100	0	4	96
17. Blue	0	33.3	100	0	11	89
18. Smalt	0	50	100	0	19	81
19. Ultramarine	0	66.7	100	0	29	71
20. Gentian	0	83.3	100	0	39	61
21. INDIGO	0	100	100	0	50	50
22. Woad	0	100	90	0	56	44
23. Violet	0	100	80	0	62	38
24. Purple	0	100	70	0	68	32
1. Tyrian	0	100	60	0	74	26
2. Pucelle	0	100	50	0	80	20
3. Mauvure	0	100	40	0	86	14
4. Amaranth	0	100	30	0	91	9
5. Mulberry	0	100	20	0	95	5
6. Rubracinth	0	100	10	0	98	2
7. MAGENTA	0	100	0	0	100	0
8. Cherrose	12.5	100	0	2	98	0
9. Carmine	25	100	0	7	93	0
10. Red	37.5	100	0	14	86	0
11. Garnet	50	100	0	21	79	0
12. Crimson	62.5	100	0	28	72	0
13. Scarlet	75	100	0	35	65	0
14. Cardinal	87.5	100	0	42	58	0
15. VERMILION	100	100	0	50	50	0
16. Mandarin	100	83.3	0	61	39	0
17. Orange	100	66.7	0	71	29	0
18. Pyridian	100	50	0	81	19	0
19. Safran	100	33.3	0	89	11	0
20. Aurise	100	16.7	0	96	4	0
21. YELLOW	100	0	0	100	0	0
22. Flavelle	100	0	10	98	0	2
23. Chartreuse	100	0	20	95	0	5
24. Mascagna	100	0	30	91	0	9

Rear Projection in the Theater

By J. L. STABLEFORD

One of Europe's leading screen manufacturers, in presenting the accompanying paper before the British Kinematograph Society, makes out a strong case for widespread use of rear projection in the motion picture theater. Existing structures and equipment are a decisive factor against any early move in this direction.

REAR projection was probably introduced into early theaters because of structural difficulties. For example, old type music halls, where it was not feasible to build a conventional projection room, were converted to back projection. The screens in such cases usually consisted of cotton.

A cotton sheet will produce a substantial real image by rear projection, but direct rays of light will pass through the weave and completely mar the viewing. Therefore, the cotton was treated with a type of varnish or linseed oil medium, and was even kept continuously wet by dripping water down it.

Judged by modern standards, the picture was unsatisfactory, even when the screen was new. The doping medium rapidly oxidized and collected surface dirt. The actual fibre of the fabric itself having a high refractive index therefore had considerable opacity. Whilst acting as an efficient diffuser, it also acted as an even more efficient absorber or stopping agent.

Another unfortunate characteristic of this type of screen is that it acts as an *efficient front projection screen;* the doping of the fabric somewhat reduces this effect, but the net reflectivity is still substantial, probably of the order of 50%.

Reflectivity of Translucent Screens

If a rear projection screen reflects back towards the incident ray something like half the total available light flux, there is only one-half of this light flux available for useful work. Of this remaining half, about 25% is absorbed by the textile material of the screen. The light that is available to form an image on the front surface of the screen is much attenuated.

A number of theaters have survived in this country to the present day with back projection—somewhere between 30 and 40 out of a total of nearly 5000—but I do not recall any theater which has been designed and built for use with rear projection.

Our greatest sensation of stimuli is received by foveal or central vision, where the acuity is of a very high order. This foveal vision functions over an extremely narrow arc, approximately 1°, and the fact that we appear to see things with great sharpness over a substantial area is due to the fact that the foveal vision is scanning at very high speed the dominating centre of interest. The remaining visual impression is gathered by macular or peripheral vision, which is not sensitive at high brightness levels. However, it has about 16 times the sensitivity of foveal vision at low brightness levels, to enable us to deal with low levels of illumination.

Objective consideration will suggest that only rarely does acute vision stray to the edge of the screen.

Matte and Beaded Screen

By far the most generally used screen for front projection today is the matte white. This gives a first-class picture over a very wide angle, with a reflection factor of about 0.7. It is rather lacking response in blue and this is accelerated as, with increasing age, it yellows and finally browns, due to the deposition of tobacco tar. This tar exists in astonishingly high concentration in our film theaters.

The glass-beaded screen, the second in general use, also suffers from the latter defect, but its virtue is that it gives a much brighter picture over a narrow angle, refracting and reflecting the ray in the direction of the light source. Thus, it should be used only under appropriate conditions. At the peak of its reflectivity curve, it can give a factor of 2.0 or 3.0, taking 1.0 as the reflecting factor of a 100% perfect diffuser and reflector.

This high response has fallen to 1.0 at about 12½° or 15° from the normal to the screen, that is, a solid angle of 25° to 30°. The curve is not square-topped but has a sharp apex and falls steeply from the nodal point: it continues, but rather less, steeply, beyond the above angles.

Centre-to-Side Ratio

A matte white front projection screen gives a centre-to-side brightness ratio of about 1.5 : 1 with an average projection system, and it must be admitted that a centre-to-side brightness ratio of 2 : 1 is not so rare nor so objectionable as it would appear. It is true that projection engineers as a rule strive, at great trouble and expense, to produce an illumination over a screen as even as possible, but there are many who consider that a completely even illumination over the whole of the screen is not desirable.

In my experience, a completely even illumination, even when it is of high brightness, produces a flat and uninteresting picture, and side-by-side test, with two projectors of the latest type, have shown that a picture with 1.5 : 1 or higher centre-to-centre brightness ratio has more sparkle and life than one with 1 : 1 ratio. Indeed, this is very much in accord with our normal sensation of seeing.

There are several fundamentals in which motion picture presentation falls short of nature, *i.e.,* completely natural color; adequate contrast ratio; and method of masking the picture. Stereoscopy is omitted for the reason that it is outside the orbit of this paper.

Completely Natural Color

If in the studio colors are painted in with all the delicacy of nature, it is to be feared that a high proportion of them will be reproduced only as monotone grey. There are two reasons for this.

Frequently the picture is inadequately lit, consequently there is insufficient contrast ratio to generate color in the lowest lights. The spectral response of even a new front projection screen is lacking in blue; as a screen gets dirty, there is a pronounced shift further to the red: it is equivalent to projecting color through a pale yellow filter, then a dark yellow filter, and finally a brown filter.

Contrast Ratio

Front projection screens as used today have been stabilized as to their contrast ratio. Their very efficiency as a reflecting agent limits their capacity for contrast. A picture is produced only by relative brightness; highlights must be produced at such intensity that the screen already illuminated by the house lights appears in the low-lights relatively black.

An efficient back projection screen is a very inefficient front projection screen, so that high orders of maintained house illumination have, consequently, a very reduced capacity to debase or degrade the low lights of the projected picture. This principle is being used in an ever increasing fashion in domestic television, by using a dark filter placed in front of the cathode-ray tube, so reducing the front reflection effect.

Change in Method of Masking

Viewing a motion picture through the encircling frame of a dense black mask is not the manner in which we normally view anything seen in nature. It must produce some jarring effect on the retina, particularly as the motion and changing light value at the edge of the screen, so

abruptly cut off, are in the main viewed by peripheral vision, which is extraordinarily sensitive to movement and low key illumination.

It is obvious that a good deal of unconscious accommodation has to be done by the eye to cope with these conflicting factors. The black mask is a relic of the days when we had insufficient illumination to produce a first-class picture, and subterfuges like this were almost compulsory.

If the black mask were suppressed and the picture gradually merged into the auditorium, less eyestrain would result.

This proposal is introduced herein because, if the suppression of the hard masking is carried out under conditions of back projection, it is thought that colors will appear more water-clear and natural, and particularly the blacks much blacker. The eye will lack the hammering effect of the black border, which does not help quiescent adjustment to the picture it is viewing. It might also be said that the picture will have a spatial effect rather than that of a peep-show.

Studio Rear Projection

Rear projection has been in use for many years in the film studios, although up to about three years ago it had reached a static stage in so far as the screens were concerned, the main developments continuing along the lines of obtaining ever more illumination. Even in the film studios, however, rear projecton was looked upon with suspicion. It was used for passing window shots in train or taxicab scenes and limited to a very small area of the picture. One half of 1% of the whole film footage would probably represent the average use of rear projection up to 1945.

The screens used in the studios were usually made of cellulose acetate, and although a certain amount of experimental work had ben done on them, the characteristics were accepted as fairly standardized. Their overwhelming defect was the hot-spot effect.

Some modification of this defect was produced by coating the centre of the screen with an absorbent agent, in order to deaden some of the brightness in that region. This expedient only partially met the trouble, as the extra opacity was effective only from one viewing point. As the studios were concerned only with one viewing point—the lens of the camera—this defect was not of much consequence.

'Independent Frame' System

During 1946, a new conception of film production was envisaged, known as "Independent Frame." One essential requirement of this process was that 80% or even 90% of the film footage was shot with process rear projection, and it will be obvious that the very gravest optical problems had to be faced in embarknig upon such an undertaking.

The essential characteristics of the desirable screen were that it should have no hot-spot from any viewing angle, when viewed with the picture in the gate, and only traces of a hot-spot when viewed with clear projection illumination. It had to provide a sufficiently even picture over a wide angle so that the camera could pan, zoom or track, and the actors move about in front of the back projection screen without the effect showing in the resultant film. In fact, its characteristics should provide almost the same amount of scope and freedom as given by an orthodox set.

Characteristics of Translucent Screens

Measurements of screen characteristics, which were taken in the experimental work on screens, used as a datum a theoretically perfect lambert surface with a factor of 1.0. The lambert surface readings were taken at the same time as the other curves. Fig. 1 shows such curves. The range varies from a centre brightness 15 times that of the theoretical lambert surface to a 1.5 : 1 ratio. The latter, however, is very dense and produces an unnecessarily high loss in overall illumination. For normal work, a centre-to-side brightness ratio of between 2 and 3 : 1 was completely acceptable, and this gives a brightness, as compared with a theoretically perfect lambert surface, of 3 or 4 times.

These are very high orders of efficiency and are probably beyond the scope of any generally used front projection screen material. It must be observed that the best of these screens were capable of producing a standard of quality beyond that required for entertainment purposes, since they had to be photographed by a camera, the film processed, positives made and then reprojected in a theater —all this tending to degrade the definition and quality.

Theater Tests of Screens

As a practical experiment, four theaters which were using back projection, and all of which had for long dissatisfied projection engineers, were selected. No particular screen characteristic was aimed at; what was thought would be a satisfactory screen was tried. It must be said immediately that the resultant picture, from the first showing, produced an astounding effect. On a picture 18 feet wide, the quality and brightness were better than anything seen in the West End (London de-luxe theaters) or elsewhere. There was no sensation of hot-spot, and the coverage from the widest front seats were quite adequate.

An interesting characteristic was the spectral response of the screen. The picture shown on this occasion was "The Red Shoes"—a film which was a distinct step forward in the handling of color as an art. In this film, several of the scenes are shot with the chief actors wearing evening dress, and, as is usual, their shirts were pale blue in color. On normal front projection screens, either matte or beaded, which have a minus-blue reflec-

(Continued on page 27)

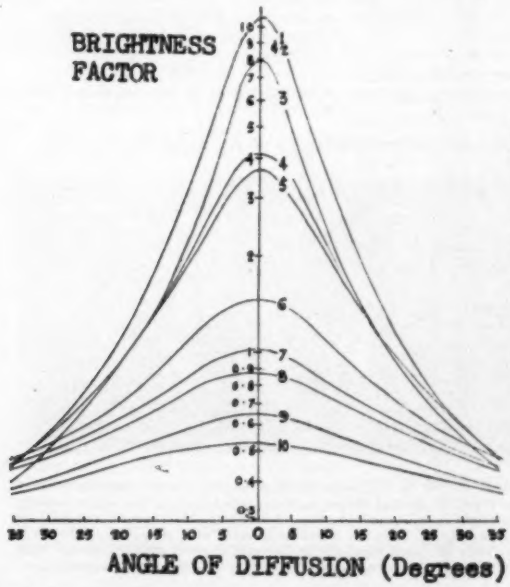


FIGURE 1

Characteristic curves of various types of translucent screens, obtained by the use of different grades and quantities of powdered glass. It will be seen that the range varies from a center brightness 15 times that of the theoretical lambert surface to a 1.5:1 ratio. The latter, however, is very dense and occasions a high loss in overall illumination.

IN THE SPOTLIGHT

By *HARRY SHERMAN*

UNDERSCORING the importance attached by Labor to the matter of wage ceilings in an industry where no price ceiling is in effect (such as motion pictures) was the attendance at the recent hearings held by the Wage Stabilization Board in Washington in an attempt to unravel this knotty problem. Labor is unreservedly and unremittingly opposed to any such one-sided situation, its stand being that any leeway extended to industry in the way of exemption from price ceilings should extend to cover the workers therein.

Included among the principal witnesses appearing before the WSB special panel which was set up to decide the question were Frank R. Murdock, general counsel for the IA and Robert W. Gilbert of the AF of L Film Council. The IA counsel laid it flatly on the line:

"In World War II, I was very close to this price and wage picture, as many of you know. At that time there was general compliance. Today, although we have a Korea, we have no Pearl Harbor. Without a Pearl Harbor, we have and will have no voluntary compliance.

"Congress made it quite evident, when it did not include these industries in the price-fixing blanket, that it did not intend them to be brought under any wage ceilings. Our employers are selling and we are producing intangibles. There is talk of hoarding. How can there be hoarding in the amusement field?

"Are people going to see more pictures or more shows because there may not be any more movies or shows? Are prices going to increase beyond what the traffic will bear? How can there possibly be any skyrocketing of wages in our field? We have had to fight for every extra nickel that we have squeezed out of our employers."

This viewpoint seems to us to make sense, not because it gives Labor a break but because it is equitable.

In passing, it might be mentioned that those workers in industries which have price ceilings but whose Labor contracts do not provide for a cost-of-living increase, are in a tough spot. Their employers need only shrug and point their fingers at the WSB and utter only a single word, "forbidden."

• While we're on the topic of workers' welfare, we offer the following important suggestions anent your Social Security status. Here are a few things that are often neglected in the daily rush. Be sure to tell your family these four things:

1. That you have a Social Security account and that this may mean monthly insurance benefits for your family.

2. Where you keep your S. S. account card.

3. To get in touch with the nearest S. S. office in case of your death.

4. To file their claims promptly so that they may not lose any of their payments.

Also, did you know that if you elect to retire there are *three* kinds of benefits available to you? Or that in case of your death there are *five* kinds of benefits your family may elect to receive? It might be well if all workers familiarized themselves with these various benefits, and with the S. S. formula in general, *right now*. Detailed information is available at your nearest S. S. office.

• All this furor about the effect of Tv on the entertainment field has not deterred that old warrior, prexy Jimmy Petrillo of the Musicians, from swinging some nice deals for his men. His latest move was to sign two picture companies, Republic and Monogram, to contracts under which the companies will turn over to the AF of M 5% of all monies realized from the sale of Tv rights to their productions. The agreements run for three years, with all such payments, estimated to run to $2 million, to go into the union's welfare fund.

Where old Republic and Monogram films are concerned, the agreement provides that they be rescored by AF of M members before exhibition on Tv.

• The Consumers' Price Index, published recently by the U. S. Dept. of Labor, reveals an increase of 9.6% above a year ago in the retail price of goods and services bought by the average moderate-income urban family.

• IA President Dick Walsh attended the dedication service of the Carter Barron Amphitheatre in Washington D. C. last month as a tribute to the late Eastern division manager for Loew's, Inc., who died last November.

• N. Y. City Local 306 has named as its

GALA CELEBRATION MARKS 40TH ANNIVERSARY OF PHILADELPHIA LOCAL 307

Guests at the party included (left to right): Thomas J. Shea, assistant IA president; from Local 307: Abbott Oliver, vice-president; Horace Johns, business representative; and Harry Abbott, president of the Local and 8th IA vice-president; Richard F. Walsh, IA president, and William P. Raoul, general secretary-treasurer. Gold life membership cards were presented to the Local 307 officials shown here, while all Local members for 35 years or more received special lapel buttons. Charles Humphries, sec.-treas. of Local 307, did a swell job on arrangements.

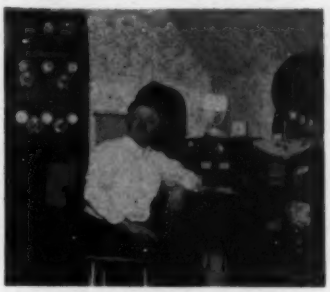
general counsel Herman E. Cooper, noted anti-Communist. He replaces Harry Sacher, who was one of the defense counsel for the 11 national officers of the Communist Party whose conviction was recently upheld by the U. S. Supreme Court. Sacher, incidentally, was cited for contempt of court during the trial and must himself serve a jail term.

• We understand that Bill Covert, 2nd IA vice-president and business representative for Toronto Local 173, is busy organizing radio and Tv workers in Canada. This may set off a jurisdictional dispute between the IA and CIO's National Ass'n of Broadcast Engineers and Technicians.

• We regret to have to record the death of Arthur F. Morrone, 71, president of the Superior M. P. Supply Co. in Pittsburgh, Penna. Born in Italy, Art came to this country when he was six. Until he went into business for himself 20-odd years ago, Morrone was a projectionist member of IA Local 171, having been in the industry a total of 45 years. He was also a member of the Variety Club.

• Among the visitors to the IP offices lately were Gus Demery, Local 173, Toronto, and Frank Jiruska, Secretary of Local 191, Cedar Rapids, Iowa.

IA-IP Radio Man of Month



Here is a likeness of Herb Kleinback as he works his amateur radio station W9RTA at Elmhurst, Illinois. A member of IA Local 110, Chicago, Herb has been on the job as projectionist at the Four Star Theater for 32 years. He is not only an outstanding radio "ham," but he is an accomplished musician as well, much of his time being given to giving his three children a thorough grounding in music.

Herb started back in 1908 as a road projectionist. He is more of a CW than a phone man and can copy a solid 35 per. If you want a really interesting QSO, contact W9RTA.

LETTERS TO THE EDITOR

To the Editor of IP:

I would appreciate any information you can give me relative to a "crackle" which I get in the sound horns behind the screen. This crackling noise shows up when I change over on either machine. This crackling is also audible through the projection room monitor.

The equipment consists of Simplex projectors, RCA soundheads and amplifier, and Brenkert lamphouses. I have audio trouble-shooting charts, but they cite no apparent reason for this particular trouble.

NEW JERSEY PROJECTIONIST

Although akin to treating a human illness by mail, IP will try to help by passing on the appended communication from RCA Service Co.:

From what little information your correspondent has given, the trouble appears to be in the main amplifier system. This type of noise could be caused by a defective tube, leaky condenser, a poor solder connection, or it could be picked up from some outside source, such as a sign flasher, X-ray equipment or motor commutator. Noises of this type have also been known to originate in the arc lamp relay contacts and other electrical circuits.

The best advice to give this man, if the theater is not on RCA Service, is to have him contact one of our District Service Offices, or one of our Field Engineers, and give the equipment a thorough overhauling. If it is a small theatre and they cannot afford a regular service call, then a demand call can be made. We believe that he would actually be saving time and money by having a qualified engineer go over the equipment.

RCA SERVICE CO., INC.

To the Editor of IP:

Here is a thought for the boys in the craft. Some of our fellows get bad breaks and wind up for prolonged periods in a hospital or a sanitorium. Why can't we more fortunate fellows who have a brother craftsman in such a spot send along a gift subscription to IP so that the man may keep abreast of what's happening in the craft against the time when he is out and active again?

It's not a million-dollar proposition, but I am sure that such a gesture would be most appreciated. Please don't publish my name.

LONG-TIME SUBSCRIBER

To the Editor of IP:

During the last few years I have picked up many thousands of feet of 35-mm nitrate film which is composed mostly of outdated trailers for which I have no use. I wonder if you know of anybody who could use this film, possibly for various experiments which IP mentioned.

I would be glad to give this film to anybody who has use for it. I should like an answer on this within a reasonable time, otherwise I will destroy the stock.

GEORGE E. READ
131 Merritt Ave., Syracuse 7, N. Y.

To the Editor of IP:

Here is our remittance for the men on the attached list. The boys all get a great deal out of IP and are extremely pleased with it. I myself have been a subscriber for many years, and having been a visual and sound projection service man in the past. I appreciate the manner in which IP keeps up with the new stuff as it comes out.

ERNEST GOSSERT
Secretary, IA Local 430, Fortuna, Calif.

Majors' Earnings Hold Up

20TH CENTURY-FOX: For *quarter* ended March 31 last a net of $874,776. Film rentals and theater receipts were $35,866,841, as compared with $35,689,073 in same quarter a year ago.

RKO THEATRES CORP.: For final operating year as part of RKO production-exhibition setup, a net of $1,195,577.

WARNER BROTHERS: For the six months ended Feb. 24 last a net of $3,827,000, as compared with a net of $5,897,000 for the same period last year. *But* the company spent $2,927,000 during the last six-month period to buy 235,300 shares of its own common stock on the N. Y. Stock Exchange.

PARAMOUNT PICTURES CORP. (not to be confused with United Paramount Theaters): For the first quarter of this year ending March 31 a net of $1,411,000, as compared with a net of $1,441,000 for the same period last year.

ALLEN B. DuMONT LABS.: For 12 weeks ending March 25 last a net of $1,022,000, as compared with $1,967,000 in same period last year. Profit was off 48% although sales advanced 25%. Lower net, it was explained, resulted from increased costs of certain critical materials, higher wage rates, and higher income tax rate. No mention of how much stockpiling was done or of expenditure for expansion, etc.

EASTMAN KODAK CO.: For 12 weeks ending March 25 last a net of $10,597,009, slightly higher than for same period last year. This despite the fact that sales for this year's quarter jumped about $35 millions.

GPL's New 16-mm Sprocket-Intermittent

FEW high-precision devices have proved as rugged and reliable as the 35-mm sprocket-type projector intermittent that operates hour on hour, year on year throughout the world. But because these are precision devices, and making them smaller calls for even greater precision, 16-mm equipment has usually been restricted to the less accurate, claw-type intermittent.

Now, General Precision Laboratory has produced a 16-mm sprocket intermittent. It is standard on four of the PA-series projectors developed specifically for use in television studios and theatre television. This new sprocket intermittent provides greater efficiency in light transmission, reduces film wear and damage to a negligible factor, guides the film without abrasion, is easily framed, and is virtually silent.

Many Advantages Cited

With the sprocket intermittent construction, GPL projectors have the following advantages:

LESS FILM WEAR—At least four teeth are engaged in the film at all times. Wrap of film around sprocket relieves the strain on film sprocket shoes; there is a smoother film acceleration during pull-down.

GREATER SCREEN BRIGTNESS—Smaller width shutter blades can be used, because of faster pull-down and smaller cutoff angle. FRAMING: The sprocket is rotated for framing, instead of displacing the aperture plate. This avoids uneven and reduced screen illumination; also avoids readjustment of projector tilt.

SIDE-GUIDING FILM—Film is guided by rotating with flange at intermittent sprocket. It avoids the wear problem of the usual spring-loaded guide shoe. LONG SERVICE LIFE—No skip movement, no fast-moving parts; automatic spring take-up for wear of star wheel teeth and cam.

GEAR BOX—Provides oil-bath lubrication, requires less lubricant attendance. Quicter operation due to insulating effect of gear box walls. EASY REPLACEMENT—Unit construction permits quick replacement, if necessary. THREADING: Sprocket teeth are in the open, always visible for threading.

Design Features of Gear Box

The intermittent is housed in an oil-filled gear box containing a cam, star wheel and synchronizing gears for motor shaft and cam shaft. Three design features insure against oil leakage: the splash system keeps the oil level below the lowest shaft bearing; all bearings are mounted in tandem with oil seals; oil shafts contain oil grooves cut in the reverse direction of shaft rotation.

The input shaft, coupled directly to an A-C motor, is geared to maintain a cam shaft speed of 1440 r.p.m. Other motors and other currents than 60-cycle A-C may be used by substituting gears that will maintain this speed for pull-down of 24 frames per second.

The cam is a hardened steel flange, about the size of a fifty-cent piece, which rotates at right angles to the 12-tooth star wheel. The cam lobe is on the side, or face, of the disc. The major portion of the flange is flat and corresponds to the dwell period of intermittent cycle. The remaining portion of the disc is raised to effect the pull-down. The cam is proportioned to give the film a dwell period of 310 degrees and a pull-down period of 50 degrees.

At each revolution of the cam shaft, one of the 12 teeth of the star wheel is engaged between the cam and annular spring. Since the normal gap is slightly less than the tooth thickness, the tooth presses laterally against the spring and is held there without vibration. Compensation for any wear is automatic in the spring loading.

Fixed Aperture Framing

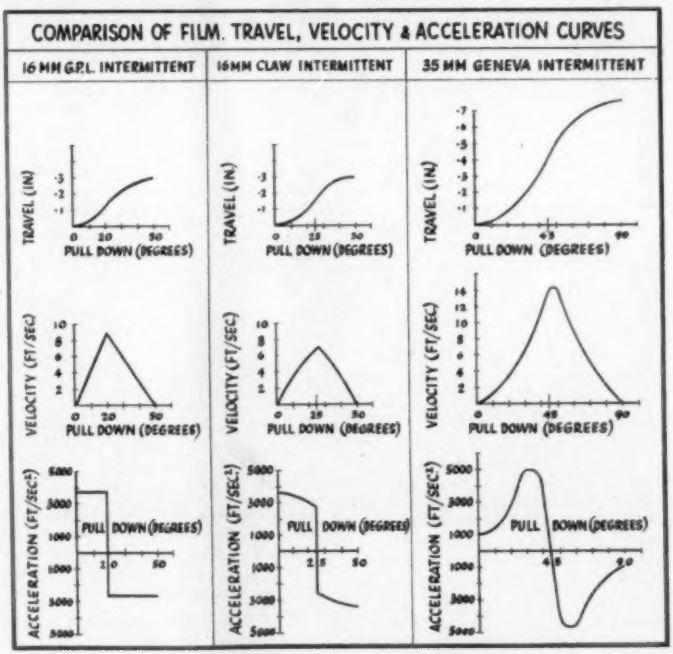
During 310 degrees of each revolution of the cam, the tooth remains motionless. In the remaining 50 degrees of turn, the star wheel tooth is indexed one-twelfth of a turn, or 30 degrees, and the next tooth in line engaged.

The intermittent works similarly to 35-mm movements, where framing is accomplished by rotating the intermittent sprocket. Film is moved into register with a fixed aperture. This eliminates two troubles common in most 16-mm projectors.

In the conventional claw-type, the aperture plate is moved up or down to mask the film picture area. But then the projected picture is displaced on the projection screen and requires adjustment of projector tilt. Also, the aperture is moved off the center line of the optical path, resulting in uneven or reduced screen illumination and poorer picture definition.

In the usual construction of 16-mm projectors, the film is guided laterally by means of a leaf spring. It bears against one edge of the film and presses the film against the opposite side of the film channel. Rubbing action is constantly against the same area and eventually results in formation of a groove, which can open splices or possibly tear film. Even padding the guide with a sapphire only delays the groove's appearance. Once the groove is present, it may weaken film guiding because of decrease in spring pressure. There is also a tendency to cock the film if the groove is uneven.

The cam lobe is shaped to give a uni-



form acceleration for the first 20 degrees of the pull-down, and a uniform deceleration for the last 30 degrees of pull-down. By spreading the deceleration over a longer time interval, the value of deceleration is reduced and in turn permits the use of less film trap drag.

Smaller Shutter Blades

The sprocket intermittent allows the use of smaller width shutter blades than in the usual 16-mm claw movement. Smaller width shutter blades are desirable in that they either increase screen brightness or permit the same screen brightness with less power in the lamp. The width of a shutter blade depends on the size of the pull-down angle and the cutoff angle. The theoretical width of the shutter blade in degrees is equal to the sum of these two angles.

The GPL intermittent sprocket has smaller width shutter blades than claw movements for two reasons: first, it has a faster pull-down angle, 50 degrees as compared to the range from 60 to 90 degrees for the usual claw movement; second, the intermittent operates on the opposite side of the aperture. This allows the shutter to operate in close proximity to the aperture where the light cone is small and the shutter can have a small cutoff angle.

Close Shutter Positioning

The shutter on the GPL 16-mm projector is perhaps closer to the aperture than on any other 16-mm projector. On the other hand, claw movements operate on the same side of the aperture as the shutter. The shutter must be spaced sufficiently away from the aperture in order to avoid interference with the claw. This requires the shutter to operate at a larger cross-section of the light beam and at a larger cutoff angle.

The new sprocket intermittent is used on all GPL projectors: the PA-100 Tv sync projector; the PB-100 portable utility, which has a special cam and shutter arrangement making it possible for an image orthicon Tv camera to pick up the picture without special phasing facilities; and the two arc propectors for theatre use: the 30-amp PB-101, and the 46-amp PB-102.

Top Safety Award to National Carbon

The National Safety Council has granted its highest honor, The Distinguished Service to Safety Award, to National Carbon Co., which firm has reduced employee accident rates each year for four consecutive years. The company's accident rate at 21 plant locations was only one-fourth the 1947-1949 national average for all industries, and slightly over one-half the rate for comparable industries.

Tv Impact on Movie-Going Charted in Mid-West Survey

MORE families owning television sets go to their neighborhood theaters than families without Tv sets, the Minnesota Poll, a sampling organization sponsored by the Minneapolis Star and Tribune, has revealed. The Poll recently completed a study of movie-going habits of Minnesotans based on a carefully prepared sampling of 598 men and women 21 years of age or older, and an analysis of the findings have been made public by the American Newspaper Publishers Ass'n.

Questions on neighborhood theater attendance, however, were asked only in a sampling of the Minneapolis and St. Paul districts. The Poll revealed that 68% of Tv set owners attend neighborhood theaters, while only 52% of non-Tv owners went to neighborhood houses. However, the first runs get a larger attendance from the non-Tv homes—28% of the individuals polled who did not have Tv said they go to downtown houses, and 20% of the set owners said they went to first-run theaters.

As to whether film-going habits change on getting a Tv set, Minnesotans reported as follows: 27% of those having Tv never go to movies, and 14% of those without Tv never go to a theater. Also, it was shown that 80% of those who have sets go less often, and only 35% of those without sets go less often.

Age Is Not a Factor

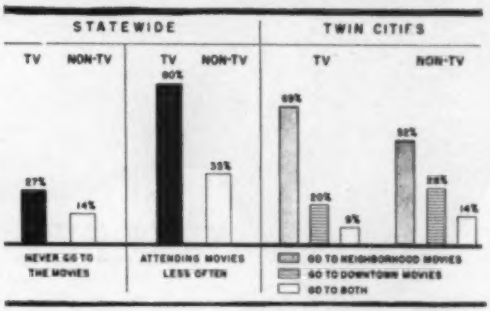
Age, apparently, is not an important factor in keeping Minnesotans from going to the movies. Only 2% said they were not going to movies because of old age. Only 3% said they couldn't afford to go or thought prices were too high.

Of those Minnesotans who attend movies, 87% receive advance information on the pictures before going to the show. Of this number, 90% said they received their information through newspapers, another 10% got the information by consulting others, 3% got it through previews, 2% by calling the theater, and 9% from miscellaneous sources.

Despite some of the negative factors

CHARTS SHOWING IMPACT OF TV ON MOVIE-GOING HABITS

How Tv Affects Movie-Going Habits



Reasons for Non-Movie Attendance

	Twin Cities Area	Outstate
Television	28%	3%
Have babies, young children	6%	5%
Can't afford it--less money for amusements, or prices too high	3%	8%
Movies aren't as good	5%	6%
Too busy	3%	6%
Age; getting old	2%	1%
Other reasons, or don't know why	11%	11%
	58% @	40% @

(@--Some gave more than one reason.)

How Information on Movies is Obtained

HOW THE 87% OF PEOPLE WHO SEE ADVANCE INFORMATION BEFORE GOING TO A SHOW GET THE FACTS

NEWSPAPERS	90%	CONSULT OTHERS WHO ATTENDED	10%
PREVIEWS	3%	OTHER SOURCES	9%
CALL THEATRES	2%		

brought out in the poll regarding the Tv impact on theater attendance, there were many bright aspects. The fact that 69% of Tv families go to neighborhood movies was encouraging. This is in direct rebuttal to the position taken by many—in forecasting the future of movies in a Tv world—that it will be the neighborhood house which will suffer most. If four-fifths of St. Paul and Minneapolis Tv set-owners still go to neighborhoods, the prospects for continued good business are bright.

Another encouraging factor was that only 6% of those interviewed out-state and 5% polled in the Twin Cities gave "movies aren't as good" as Tv as their reason.

New Vallen Catalog Now Available

A new 1951 catalog has been published by Vallen, Inc., Akron, Ohio, firm specializing in the design and construction of curtain controls, tracks and special operating devices. The 15-page catalog, printed in two colors, gives specification and installation data as well as descriptions of the items in the Vallen line. It is available free on request.

Movies are better than ever! —but how good is the HEART of your theatre?

It's good showmanship to make sure that your projection room equipment—*the heart of your theatre*—operates at peak form . . . at top efficiency. Even with the best-designed and best-made picture projection equipment and sound reproduction system, constant usage causes wear and tear. If not properly maintained, projection room equipment may cause trouble . . . run up costly repair bills . . . result in a "blackout" and loss of box-office receipts.

With RCA Service you can be sure *the heart of your theatre* is maintained in a thoroughly dependable condition. RCA Service technicians are skilled in the systematic point-to-point checkup and maintenance of all types of projection and sound equipment regardless of make. RCA Service Plans combine expert technical assistance with comprehensive parts and repair provisions for motion picture and theatre TV equipments.

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The advantages of RCA Service are yours at a cost so low, a few admissions daily pay for it. *Write for free folder—"Performance Security."*

RCA SERVICE COMPANY, INC.
A RADIO CORPORATION of AMERICA SUBSIDIARY
CAMDEN, NEW JERSEY

NEWS PROJECTIONS

EXHIBITORS squawking that while studios brag about reducing production costs, film rentals, expecially percentage pics, continue at the same high level . . . Cinecolor this year will register a 250% increase over last year on its new 2-color process . . . Next two years hold key to the future of the exhibition field, says H. M. Richey, head of Metro's exhib relations. File this under the no-news department . . . No trade show at the TESMA meeting this Fall. Reason: raw material shortages. Incidentally, Oscar Neu, TESMA prexy for the past 18 years, will not be a candidate for re-election . . Zenith Radio states that its recently concluded Phonevision test in Chicago took in $1.73 a week per family among the 300 subscribers, or 3½ times the national American family movie-going average . . . The SMPTE is now installed at its new quarters at 40 West 40th St., N. Y. City, 18 . . . So Tv "spot" announcements will help the movie box-office, will they? Well, under existing rates in N. Y. City for Class A time, a minimum campaign involving twenty 20-second-to-one-minute spots, spread over four stations, would cost $12,000!

- - -

Hollywood's production of film exclusively for Tv programs by 27 producers now exceeds the footage turned out for movie theater consumption . . . Another one of those movie theater vs. Tv surveys, This time by Woodbury College, Calif. Announced results: 58% would be willing to pay $1 for a first-run program on their home Tv set but would not pay the same amount for an exclusive major event on a large screen in a theater . . . 20th Century-Fox will have to divest itself of its theater interests, and National Theaters, its subsidiary, will be forced to relinquish 100 theaters, under the terms of a recent Dept. of Justice order in the anti-trust suit . . . Says Dave Snaper, prexy of New Jersey exhibitors group: "While Lichtman (20th-Fox sales head) was mouthing (to the press) his sentiments about helping to keep theaters open, his New York branch was insisting upon higher rentals for 'On the Riviera' than they have received on any previous picture in recent years."

- - -

Reliable estimates place the number of drive-in theaters in the U.S. at 3000. Price war is raging among these exhibitors, the reason being the practice of some drive-ins charging a flat fee per car regardless of the number of occupants, as opposed to per-head charge. Four-wall theaters have joined the drive-in houses

supporting the individual charge in protesting to the Internal Revenue Bureau . . . "Unless the televising of college sports events is eventually put on a pay-as-you-see basis, the entire college sports program faces the threat of collapsing," states Bob Hall, athletic director of Yale. He pointed out that more than 72% of the revenue needed for the entire Yale sports program comes from football game receipts, which have been seriously affected by Tv.

The Time is Now!

By NAT GOLDEN

National Production Authority

IF THEATER equipment is obsolete or inefficient and has not been recently modernized, *now* is the time to do it while the equipment is available. Waiting until one can simultaneously remodel his theater may be fatal on the score of losing one's competitive position.

In the past, many theater owners have refrained from modernizing their equipment, particularly projection and sound reproducing equipment, unless they were able to simultaneously do a remodeling or refurbishing job. Apparently, the basis for this is that the theater parton may be unaware of the *equipment replacement*, and in order to appreciate the effort of the theater owner, he must visibly see the type of modernization that is involved, such as in remodeling the front, lobby, auditorium, or rest rooms.

Decrease in Equipment Inevitable

Now that such remodeling is limited to the degree where in many instances nothing can be accomplished, the theater owner inherently eliminates from his plans equipment replacement. This policy, we feel, is most short-sighted.

As the defense program accelerates, the production of 35-mm motion picture equipment must inevitably decrease. Thus, it may not be as easy to replace equipment six or eight months from now as it is at the present time. How long this program will continue is, of course, unknown, because it depends on world affairs.

Theater owners are, therefore, strongly urged, as are other segments of industry now, to launch their modernizing programs immediately.

LOCAL 1, NEW YORK, N. Y.

Election results: Vincent Jacobi, *pres.*; George Fitzgerald, *vice-pres.*; John C. McDowell, *sec.*; John J. Garvey, *treas.*; Solly Pernick and John Goodson, *bus. reps.*; Louis Yeager, *Tv. organizer*; John McCarthy, *sgt.-at-arms*; Joseph Hughes, *replacement committee.*

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Film Projection in Israel

By A. ZEHNGEBOTH
Chief, Zlil Theater, Jaffa

IN ISRAEL, nearly all employees of both film and the legitimate theaters, including actors, are organized as a section of the Histadruth (General Federation of Labor), which not only negotiates for wages and working conditions but also conducts examinations for competency, notably that of projectionists.

Wages would correspond to approximately $300 monthly for a first projectionist or cashier, and about $225 for ushers. Payday is every four weeks, including two weeks vacation annually with pay. We give three shows daily for six days of the week, with two evening shows off each week. All previews and extra shows are paid for separately.

Except for one theater now being constructed by 20th Century-Fox, all movie theaters are privately owned, some of them by cooperatives whose members do all the work themselves. I myself belong to such a cooperative of disabled veterans. Being both owners and employees, we are in the unique position of being members of both the Cinema Owners Association and the Federation of Labor.

In the bigger towns, tickets sell for about $1, with 40% of this amount going for municipal and Government taxes. Film theaters are overcrowded: in Tel Aviv, for example, there are only 10 theaters with 14,000 seats to accommodate a population of 1¼ million.

Varied Projection Equipment

Throughout Israel there are about 120 film theaters equipped with 35-mm projectors. There are many Ernemann (German-made) projectors, some of the newer type with water-cooled gates, and not a few which have served well for 17 years. British Kallee also has quite a number of installations; but there are few American makes.

We also have about 200 16-mm theaters in small settlements, with most of the projectors being either Bell & Howell or RCA. We use many American-made speakers, rectifier bulbs and carbons, the latter being difficult to obtain. Since we have no very large theaters, or drive-ins, our arc current seldom passes the 60-ampere level. American-made films predominate.

Each producer affiliated with the distributor's organization maintains his own office and facilities for circulating films. The theater receives its film in tins, never on reels. The inspection of film by the distributors is very lax with repairs seldom being made.

Distributors are always straining to squeeze a few more runs out of a poor print, and projectionists must be especially vigilant to spot and repair film deficiencies. In fact, it is due solely to the efforts of proectionists that we have not had a serious film fire for years.

ANSWER TO YOUR TECHNICAL PROBLEMS...

The Altec Service Man and the organization behind him

The Altec Service Man

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All take-ups wind film on 2, 4 and 5 inch hub reels.
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THE CLAYTON REWINDER
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We See Upside Down

WHEN a simple lens casts an image, the image is reversed both up and down and side to side. Use the lens of an ordinary reading glass to throw an image of a lamp on a sheet of paper, or look at the image on the ground glass screen of a camera, and see that this is true.

The eye is often compared with a camera, and rightly so. Like a camera, the eye has a lens system that bends the entering light, forming an image of what is seen on the retina, or sensitive back surface of the eyeball. The pupil—the round opening at the front of the eye—controls the amount of light that enters, just as the diaphragm of a camera lens does.

If the eye acts like a miniature camera, then the image on the retina must be upside down. Why, then, do we not see things turned wrong way up—chandeliers sprouting from the floor and

chairs and tables hanging from the ceiling? The reason is that from earliest infancy we have learned to interpret the upside down images as being upright.

A Simple Experiment

Here is a little experiment to convince yourself that the retinal images are really upside down. Hold a pencil a few inches from a piece of paper lying on your desk so that a lamp casts a shadow of the pencil on the paper. If you now hold a reading glass just below the pencil, the lens cannot reverse or otherwise change the shadow because the pencil is too close to it.

Now do the same thing, using your eye in place of the reading glass: stick a hole in a card with a pin, holding the perforated card about half an inch in front of one eye, and look at a bright surface such as a lighted lampshade or the sky. Grasping the pin by its point, hold it between card and eye and move its head upward in front of the hole. What you see is a shadow picture of the pin moving downward across the hole. We know from the reading glass experiment that the shadow on the retina is right side up; your brain, however, interprets it as being upside down!

Electronic Materials Shortages

Following a discussion by industry representatives anent availability of materials for electronics equipment, NPA officials indicated a continuing tight situation in the following:

Tungsten: There is little relief in sight despite a plan under consideration to purchase additional supplies abroad. A considerable reduction is expected in the amount of tungsten available during July and August. NPA said the industry could assist in meeting defense needs by providing a program of estimated requirements for the remainder of 1951 and for all of 1952.

Cobalt: The future picture for cobalt is somewhat brighter than for tungsten, despite the industry's report of growing shortages of products using cobalt.

Nickel: Little immediate relief is to be expected, although CMP procedures should ease the situation to some extent for the electronics industry.

Fine Wire: Although there is no immediate problem in fine wire drawing production, tube programs for radar and other military and essential industrial uses probably will create shortages.

NPA's Controlled Materials Plan

Under Controlled Materials Plan, effective in the third quarter of 1951, all manufacturers of motion picture-photographic products (equipment, accessories and motion pictures) are required to submit during the month of May their requirements on CMP 4B forms, the NPA announced. NPA will soon make an announcement on the rules, regulations and procedures to be followed with respect to the Controlled Materials Plan, and the various forms involved.

PERSONNEL

WALTER W. SIMONS, sound picture pioneer first with Vitaphone, then with ERPI, and then with Altec Service Corp. for many years, is now associated with Altec Lansing Corp., Beverly Hills, Calif.

W. F. KELLEY, secretary-treasurer of the Motion Picture Research Council, Hollywood, has been awarded a certificate of service by the American Standards Assoc. for his contribution to the development of American Standards.

FRED WHITNEY, formerly with Altec and ERPI, has joined the SMPTE staff to oversee test film technical operations. A formal quality control program will insure consistently high quality in the SMPTE test films, which are largely responsible for the present high level of quality of reproducing equipment in the 35- and 16-mm fields.

JOHN R. COLEMAN and DR. L. C. FAULKENBERRY have been appointed assistant superintendents in the film emulsion coating division of Eastman Kodak.

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THE NEW WIRE-BRUSH SCRAPER

Perfect For The New Safety Stock

Zip goes the emulsion and off goes the binder. The sharp hardened steel scraper blade does part of the job—and the spring steel brush does the rest, roughing up and fogging the base for proper cement penetration.

A Must For Every Projectionist . . . Use With Your Present Splicer.

Buy your Neu-Zip scraper from your favorite dealer. He has them on display. Just pick yours off the card, and your splicing worries are over.

Recommended by Eastman
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330 W 42nd St New York 18, N Y

The 'Neu-Zip' Combo Film Scraper for Safety Film

Wrong Correct

FIGURE 1

The ever-increasing use of safety film has occasioned the development of a new combination wire brush-scraper blade device for use in splicing film. This new unit, known as "Neu-Zip" and developed by Neumade Products Corp., is now available at the very low price of $2.95 through all theater supply dealers.

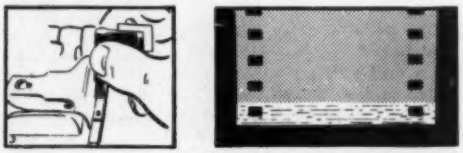
Neu-Zip was developed at the suggestion of film handlers of long experience in theaters and exchanges, who found that there is an essential difference between nitrate and safety stock. In the latter, there is a binder between the base and the photographic emulsion which is tough and glossy, making proper splicing more difficult than with nitrate film.

The Neu-Zip combines the conventional scraper blade with a stiff wire brush, both of which are used on the film. After scraping with the blade, a flick or two with the wire brush across the area to be spliced removes all traces of the emulsion and the binder and "fogs" the base to allow film cement to penetrate and make a perfect weld.

Before using Neu-Zip a minor adjustment of the splicer is necessary. For example, on the Griswold splicer the cement guard is a fraction of an inch away from the scraping blade. This guard on the upper left jaw should be moved to the right so that it comes just barely to the edge of the blade, as shown in Fig. 1. In Fig. 2 is shown the use of the wire brush so that the film has the frosty appearance shown in the right-hand section.

If desired, both the emulsion and the binder may be removed by the use of the steel brush alone. To clean the brush and restore to original shape requires only a simple twisting between the thumb and forefinger. The unit, individually boxed with instruction sheet, is recommended by Eastman Kodak Co.

FIGURE 2



U.S. Air Force Stereo Color Film

A three-dimensional color process invented by Maj. Robert V. Bernier, Air Force, employs a single film, requires some alteration of the projector, and spectators wear Polaroid glasses. The Air Force has taken out patents in Major Bernier's name.

Process, in development for 16 years, employs a system of alternate frames to eliminate projection of a second film, while a revolving shutter with alternate concave and convex mirrors is attached to the projector. 16-mm color film is used.

Your Very Best Buy

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A Sprocketless Developer

A SPROCKETLESS developing machine for motion picture film has been developed in Europe in which the film in a flattened helical path is carried on racks whose single upper and lower rollers have neither flanges nor sprocket teeth. Overlapping of adjacent strands of film is prevented by fixed separator fingers at the sides of the rack where the film approaches the rollers.

Swelling and shrinkage of the film are accommodated by a change in effective roller diameter in response to tension in the film strands. It is said this machine can be converted from 35- to 16-mm film merely by changing the strand-spacing fingers, with a corresponding increase in film capacity. Alternatively, 16-mm film can be spliced to 35-mm and permitted to follow it through the machine with mechanical adjustment.

French Lenticular Film System

THE LENTICULAR color film process employing a lenticular positive has been revived in France under the name "Opticolor" by the Société Civile de Recherches Scientifiques B.L.V.

The problem of printing from a lenticular negative is avoided by making three color-separation negatives simultaneously in a beam-splitting camera provided with a prism block and three lenses working at an aperture of F:2, and of variable focus from 30 to 68 mm. A special printer has been developed in which the three separation images are printed on a lenticular positive film having 30 minute lenses to the mm. in the picture area only.

RCA and NBC joined in urging the FCC to take immediate steps to lift the Tv "freeze" and permit new stations. Considering the amount of critical materials which go into Tv stations and transmitters, no less than the tough attitude of NPA, the bid likely will fail.

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REAR PROJECTION

(*Continued from page* 17)

tivity, these are reflected as a clear white. On the back projection screen, they were reproduced quite distinctly as pale blue, although it is doubtful if the ordinary patrons noticed this particularl characteristic.

Practical Factors of Rear Projection

Some of the more practical factors in using back projection will now be dealt with.

During a busy evening, a film theater loses a high proportion of its picture illumination through scattering of the rays, both incident and reflected, in the dense tobacco haze. In foggy weather this effect is increased, and under bad conditions the loss of light arriving in the retina of the patron can be as high as 40%. More than half of this loss can be saved by back projection—that is, the whole of loss in the incident ray, and shall we say that in the reflected ray. This is no mean attraction.

Again, it must be confessed that light scattered from the incident ray is most irritating to a patron sitting beneath it. Without any apparent loss of picture quality, it would be possible to increase greatly the maintained house lighting.

The location of the projection room brings in a number of important factors, the most important of which is the length of throw. If we take a 2-inch lens as a datum, a 20-foot picture needs a 48-foot throw. This is an inconvenient length to find and cloak with a tunnel.

Projection by Mirror

The most obvious answer to this is to fold the ray once by means of a mirror, the projection room being placed immediately under the stage, where it could be housed conveniently as a suite. The ray would be projected from a point as near to the bottom picture line as feasible, upon a mirror placed approximately half-way along the throw. This would necessitate a 10-foot plate-glass mirror. The use of a mirror would not produce any noticeable loss of definition. The weak "ghost" image from the front surface of the mirror, if the latter were of ¼-inch plate glass, would be so near the main image that probably it would be separated by less than the grain size of the film stock, as magnified on the screen.

The mirror would cause a loss of light of between 9 and 12%, according to its state of cleanliness, but this would be more than offset by the increased T-value of the longer focal lens, which the double throw permitted. There is an additional advantage in using a mirror: the projector could be threaded with the film the normal way round and not laced back to front or, as has been the usual practice, the picture reversed through a prism.

Life Expectancy of Screens

The type of rear projection screens we are discussing seem to have a life of three years or more, depending very largely upon missiles projected by young patrons. Unfortunately, they are very expensive screens to produce, so that amortized over a period of three years, the standing charges are somewhat higher than those for front projection, although it is thought that part of the expense might be saved by alleviation of resurfacing costs.

Insufficient experience has been gained in the use of such screens in the theater

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29 BRANCHES • COAST TO COAST

to know the maintenance problems, although it can be said that in the film studios they are washed regularly with soap and water. The inevitable deposition of tar will not have such a disastrous effect upon them as it has upon a matte white screen or a beaded screen.

A matte white screen is a reflecting agent by reason of the white particles of its makeup (omitting the more technical cause and effect). If these particles are impregnated with a brown staining agent, such as tobacco tar, their very capacity to reflect has been destroyed to the extent of the color to which they have been stained.

If a translucent type of screen is stained to the same degree, its inherent capacity for transmission of light has not been destroyed at all. All that has happened is that a transparent filter, from the deposition of tobacco tar, forms on its surface.

Effect of Increased Brightness

If by increased brightness visual acuity is stimulated, then the magnification factor can be reduced. This is aptly illustrated when one views an object under a reading lamp for closer examination: the acuity increases, and as the viewing distance or magnification is left unchanged, the sight stimulus is increased.

The inference is that the increased brightness and increased acuity which the back projection screen can provide could lead to a substantial reduction in picture size without loss of visiual sensation.

A smaller picture will improve the viewing conditions and sightline problems in almost all theatres, although it is not suggested that any wholesale reduction in size be contemplated. As an illustration of what must be the extreme in this, a special high reflection type of screen using a 20-foot picture was being tested. When showing a richly colored scene under starlight conditions, a group of experienced theater controllers and technicians were able to see an acceptable picture at 1800 feet viewing distance. This is the unbelievable ratio of 90:1.

Sound Reproduction

There is one final aspect of rear projection that must be mentioned, but on which no opinion will be passed, and that is sound reproduction. Obviously, one cannot have a perforated rear projection screen, and sound must therefore be disseminated from outside the screen periphery. Standard practice nowadays is to put the high-frequency speakers above the centre of the screen, and the low-frequency speakers on either side, all three radiating through the wool masking. Theater engineers who service such theaters have reported that they receive no complaints on sound and that, in their opinion, this arrangement is a workable one.

[*The advantages of back-projection were the subject of a number of demonstrations. Two identical 16-mm projectors ran matched prints side by side, one with front and the other back projection, the latter showing a marked superiority in brightness and contrast ratio. On a 2 ft. screen, a picture was shown to be of adequate entertainment value at a distance of 30 ft.—a ratio of 15:1. Another demonstration showed that the use of a mirror in the beam caused no perceptible loss of definition. The small effect of ambient lighting was also shown.*]

SUPPLEMENTARY DISCUSSION

Q: I believe there are considerable mechanical difficulties to be overcome in sound head construction for rear projection. The question of speaker placement is very important in view of the possibility of stereophonic sound; maybe the last place we want the sound is in the centre of the picture.

A: I think a mirror is essential, when the film can be laced up the normal way.

Q: Rear projection screens at the mo-

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ment have sometimes a centre-to-side ratio of 4 or 5 to 1.

A: The curve relating to the new screen is appreciably flatter. In the studio, we worked at an angle of 60°, and did not get more than a 2 to 1 brightness ratio. At this angle a beaded screen would show about 5 to 1.

Hot Spot Eliminated?

Q: Do I understand that the travelling hot-spot has been eliminated with this type of screen?

A: With an open gate you can just see the increased brightness in the centre. But when there is a picture in the gate, nobody would see any change in the light.

Q: Could we have further elaboration on the maintenance of rear projection screens? This seems to be the main source of trouble with back-projection.

Favorable Life Characteristics

A: The old rear projection screen had a cotton base, doped with some secret formula. Almost inevitably these screens oxidized and collected surface dirt, and the problem of cleaning was quite out of the question. When reasonably dry dopes were introduced, the problem of cleaning could be approached, but oxidation—the inevitable fall-off opacity effect—went on.

The new screen has no cotton base, and the formula of the plastic can be designed to be as nearly as possible light-fast. The life from the point of view of the maintenance of picture brightness is a very good one. The deposit of surface dirt is the same, but it is an astonishing fact that the tar deposit does not deteriorate the light value of the screen to any marked degree. The life of the screen appears to be limited by the activities of the small boy.

Q: Do you agree that it is impossible to clean any type of screen in the theater?

A: I agree that it is very difficult.

Q: Our experience is that after two years, the deterioration of the screen is much less than we should get with the ordinary front projection screen in six months. One of our control people—who is no technician—was so impressed that when he was transferred to another area I received a note asking me to transfer all his theaters from front to rear projection.

A: The reason a front projection screen turns yellow quicker than a front projection screen is that it is perforated.

Q: What would be the effect on reproduction by the screen in daylight?

A: Under daylight conditions you would not hope to get a picture with a matte screen; you would get a slight picture with a beaded or silver screen. But with a back-projection screen you would get a picture provided it is hooded to keep light rays off the front of the screen, and that no stray light struck the rear of the screen. The front-projection efficiency of a back-projection screen is of the order of .25, as compared with .7 with a matte screen. With the beaded screen the efficiency of 3 to 1 would kill the possibility of daylight projection.

Enhanced Showmanship

Q: From the point of showmanship there are two factors in back-projection. One is that the beam is invisible, the second that the picture is covered by the tabs as they close.

A: Prior to 1945 all studio screens were of American make. They had a centre-to-side brightness ratio of from 12 to 20 to 1. Efforts were made by Hollywood to produce screens for the Independent Frame process, but they never got away from the hot-spot.

Q: Do you consider that putting glass beads on the surface of the translucent screen would help? The Translux people do it.

A: It has some effect on the characteristics, but it is so much bound up with the problems of size of bead, how they are bonded, the depth to which they are embedded, and what other diffusing methods are used.

PROJECTIONISTS FIND CURE FOR "CURTAIN IRRITATION"

No patent medicine will cure the sinking feeling projectionists get when they push the curtain button to start a show—and nothing happens.

That kind of "all-gone" feeling (which makes projectionists grow old before their time) requires a strong remedy—a remedy that consists of curtain controls, tracks and special operating devices that work properly *all the time*.

Specifically, it calls for Vallen equipment. For 35 years the products of Vallen precision engineering have served projectionists all over the world faithfully and well. The superior design and construction of Vallen curtain controls, tracks and special operating devices makes them all-time favorites of the men behind the show.

To make certain the front office sees eye-to-eye with them on this important subject, wise projectionists are putting copies of the latest Vallen catalog on their bosses' desks. You can do the same. Write today to

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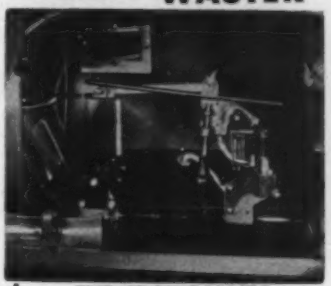

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THE MAGIC OF COLOR

(*Continued from page* 15)

colored pigments will find the following show-card water paints both satisfactory and inexpensive:

YELLOW: Carter's "Tempera" *Yellow.*
MAGENTA: Derayco "Poster" *Brilliant Magenta.*
CYAN: Carter's "Tempera" *Turquoise Blue.*

A knowledge of primary and secondary colors and the in-between hues is necessary for a perfect understanding of the various processes of motion picture color photography, film processing, and projection—topics to be discussed later in this series of articles. But now that the *saturated* colors and the additive and subtractive methods of producing them have been described, colors which are *not* saturated warrant a few words. Brown, maroon, salmon, olive, pink, lavender, flesh, and slate are examples of unsaturated colors. None of these can be found in any hue chart.

What happens when white paint is added to pure magenta paint, or white light mixed with magenta light? The resulting color is rose-pink. And when black paint is added to magenta paint, or magenta light reduced in intensity? Maroon, a purplish brown, is obtained.

In both cases the saturation of the magenta has been reduced. Pink is a *tint* of magenta, and maroon is a *shade* of magenta. Pink and maroon both have the same *dominant hue.*

The same applies to the tint "tan" and the shade "brown." Orange is the dominant hue of both. Tints of the yellow-greens are the apple- and fern-greens; shades of these hues are the olive-greens and russets.

'Shades' of Tints

In addition to these simple tints and shades we find *shades of tints.* These are the tinted grays. By adding a small quantity of black to "baby blue" (a tint of blue), slate results. And by adding black to pink (a tint of magenta), we get a rosy gray called ash-rose.

When the eye has been educated to an appreciation of these delicate unsaturated colors, observation will reveal that many of the objects which are commonly described as white, gray, or black actually possess hue. "White" clay may be bluish, yellowish, or reddish, *etc.* A "gray" stone may be perceptibly violet. A "black" lump of coal may show green, blue, and brown variegations.

Also, the "native" colors of things—the colors which things actually possess—are profoundly affected by the color of the light which illuminates them. Fresh snow is the whitest, the most nearly hueless, substance in nature. But in the light of the setting sun snow acquires various red, orange, and yellow hues; and in shadows, where it receives light only from the sky directly overhead, snow is distinctly blue.

A complete cataloguing of colors is fortunately by no means as complicated as might be thought. It has been claimed that the human eye is able to discern a total of 2,000,000 seperate colors; but this overwhelming estimate is greatly in error. To be sure, photometric devices have been made which can differentiate 2,000,000 colors. Human vision, however, does well to distinguish 1/1000 of this number.

The truth of the matter is revealed by IP's 48-hue color chart (Fig. 3). By maintaining the equal-sensation unit intervals of this chart throughout a complete color scheme of unsaturated colors, the total number of colors (including the 48 saturated colors and 13 tones of neutral gray in addition to black and white) comes out to be approximately 400.

This estimate represents all the colors and tones which can be *easily* distinguished from one another by normal vision. The very best natural-color photographic processes are unable to reproduce even half this number.

The total number of colors distinguishable from one another by normal vision is from 4 to 5 times the number which can be derived from the IP 48-hue scale; that is, from 1600 to 2000 colors including neutral tones. Only very exceptional individuals can differentiate more than 2000 colors.

[TO BE CONTINUED]

Westrex Magnetic Recorder

Westrex Corp. has announced and presented demonstrations of its new 1951 Series 1100 standard magnetic recording systems. These systems are fixed studio or portable location recording equipments for the use of 35-mm, 17½-mm or 16-mm magnetic film.

Each complete system includes two dynamic microphones, a microphone floor stand, a 2-position mixer-transmission unit, a magnetic recording machine containing the power unit and auxiliary equipment, a complete set of spare glassware and fuses, and interconnecting cables for operation from single phase, 50 or 60 cycles, 115-volt power source.

Exceptional Low Noise Level

A new line of amplifiers and transmission equipment has been developed having exceptionally low noise to take full advantage of the inherent signal-to-noise ratio of magnetic film. The complete recording transmission circuit consists of three amplifiers, two microphone preamplifiers, and one main recording amplifier. They are small in size, each with a normal flat gain of 70 db from 30 to 10,000 cycles. There frequency characteristic may be changed by means of interstage plug-in equalizer units.

Only one type of spare amplifier is required, thus reducing maintenance. If it is desired to change the transmission frequency characteristic, it is done merely by changing plug-in equalizer units.

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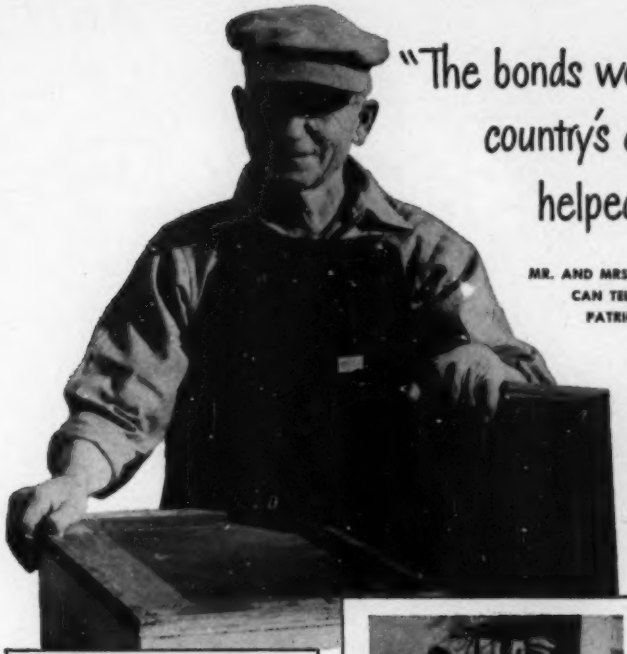

Mr. Whatley inspects a beehive on his 202-acre farm. "I wouldn't own a farm, clear, today," he says, "if it weren't for U. S. Savings Bonds. We bought a new truck, refrigerator and electric range, too. I've discovered that bonds are the best way of saving for a working man."

Mr. Whatley says, "My wife and I bought our first bonds in 1943, through the Payroll Savings Plan at the Martha Mills plant of the B. F. Goodrich Co. in Thomaston. Our pay averaged $40 a week apiece and we put about a quarter of that amount into U. S. Savings Bonds."

"We'd saved $6,925 by 1950. $4,000 bought us our 202-acre farm and a 6-room house. Then we bought a new truck, a refrigerator and electric range. Now Mrs. Whatley has time for tending her flowers while I can enjoy my hobby of bee-keeping. We owe it all to *planned* saving."

"We're still holding bonds, too. We don't believe that anyone should cash his bonds unless he has to, so we're holding about $1,800 worth. With that cash reserve, and our farm clear, we can grow old with comfort and peace of mind. Everybody should buy U. S. Savings Bonds!"

The Whatleys' story can be your story, too!

You can make your dream come true, too—just as the Whatleys did. It's easy! Just start *now* with these three simple steps:

1. Make one big decision—to put saving *first*, before you even draw your pay.

2. Decide to save a regular amount *systematically*, week after week or month after month. Even small sums saved on a systematic basis, become a large sum in an amazingly short time!

3. Start saving automatically by signing up *today* in the Payroll Savings Plan where you work or the Bond-A-Month Plan where you bank. You may save as little as $1.25 a week or as much as $375 a month. If you can set aside just $7.50 weekly, in 10 years you'll have bonds and interest worth $4,329.02 cash!

You'll be providing security not only for yourself and your family but for the free way of life that's so important to us all. And in far less time than you think, you'll have turned your dreams into reality, just as the Whatleys did.

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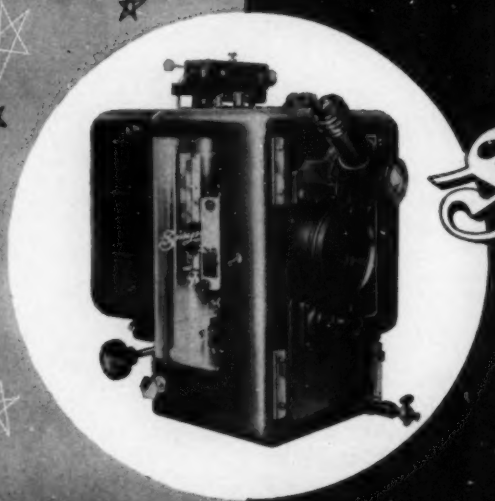

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